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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

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THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ON THE HEIGHT OF THE LAND AND THE DEPTH OF THE OCEAN.

By John Murray, of the *Challenger* Expedition.

Read before the Royal Society of Edinburgh, 19th December 1887.)

I.—The Area of Land at Different Altitudes above Sea-Level.

Among the ancients, Aristotle, Posidonius, Pliny, and other philosophers speculated as to the height of the land and the depth of the sea, but their ideas on the subject were necessarily vague, and they had usually to confess themselves in a special manner ignorant of the depth of the sea. Posidonius stated that the Mediterranean, near Sardinia, had been sounded to 1000 fathoms, which he considered the greatest depth that had ever been attained.

Hu Khaldoun, who flourished in the fourteenth century, remarks that it is a providential arrangement that the highest mountains are situated near the sea, to resist the invasion of the ocean. In general, there is little orographical or bathymetrical information to be gleaned from the writings of the Arabian geographers.

Marsigli,[1] who lived in the latter part of the sixteenth century, combated the view of those who held that the sea had no bottom in some places, and argued that there was a symmetry between the heights of the land and the depths of the ocean, and views similar to his prevailed during last century.

Laplace, in his *Mécanique Céleste*,[2] arrived at the conclusion, from theoretical considerations, that the mean height of the dry land was 3280 feet (1000 mètres), and that the mean depth of the ocean was, likewise, 3280 feet.

The first systematic attempt to estimate the mean altitude of the land above sea-level is due to Humboldt. His method consisted in drawing across the continents a series of vertical sections in parallel planes, in estimating the surface of these planes comprised between the edge of the profile of the soil and a line representing the level of the surface of the

[1] *Physical History of the Sea*, Venice, 1711.

[2] Vol. v. p. 16.

sea. The arithmetical mean height of two successive sections multiplied by the area comprised between the two sections was considered as expressing the volume of the corresponding portion of the continent. All the elementary volumes thus obtained were added together, and the sum divided by the superficial area of the whole continent. In this way, Humboldt obtained for—

Europe	672 feet	(205 mètres)
Asia	1151 ,,	(351 ,,)
N. America	748 ,,	(228 ,,)
S. America	1132 ,,	(345 ,,)

He estimates, thus, the mean height of all continental lands at 1007 feet, or 307 mètres.[1]

In 1874, Leipoldt, after a detailed discussion of the different areas, estimated the mean height of Europe at 974 feet, or 297 mètres.[2]

Reclus[3] discusses the mean height of the various continents, but he does not seem to have made any independent measurements or estimations.

The most recent attempt to estimate the mean height of the land has been made by Lapparent in his *Traité de Géologie*.[4] He proceeded by calculating the area of the surfaces of each zone between contour lines, 0 to 200, 200 to 500, 500 to 1000, 1000 to 2000, and above 2000 mètres on the orographical map in Stieler's Atlas. This he did by laying squared transparent paper over the map, by counting the number of squares comprised between each of the contour lines, calculating the area of each, and then multiplying the areas thus obtained by heights selected for each zone. For the first zone (0 to 200 mètres) he used 100 mètres; for the second (200 to 500), 300 mètres; for the third (500 to 1000), 700 mètres; for the fourth (1000 to 2000), 1300 mètres; and for greater heights his numbers were 2000, 2500, or 3000 mètres according to circumstances. He then obtained the percentage which each zone contributed to each continent. His results were as follows :—

Europe	958 feet	(292 mètres)
Asia	2884 ,,	(879 ,,)
Africa	1975 ,,	(602 ,,)
N. America	1952 ,,	(595 ,,)
S. America	1762 ,,	(537 ,,)
Oceania	1188 ,,	(362 ,,)
Mean for all the Continents	2120 ,,	(646 ,,)

He obtained a minimum result by taking the lower limit in each zone for the height except in the case of the first (0 to 200), where the height was taken at 100 mètres. His general conclusion is that the mean height of the continental land of the globe is above 1640 feet (500 mètres) and, more probably, near to 1968 feet (600 mètres), being the double of the number previously accepted.

[1] Humboldt, *Asie Centrale*, Paris, 1843, vol. i. p. 165.
[2] Leipoldt, *Uber die mittlere Höhe Europäs*, Plauen, 1874, p. 183.
[3] *La Terre*, 4ème edit., Paris, 1877, vol. i. pp. 81-83. [4] 2ème edit., Paris, 1885, p. 63.

In the present paper an attempt is made to give a numerical expression to the areas of land at different levels above, and of the ocean's floor at different depths below the surface of the sea, as well as to the bulk of the dry land, and the bulk of the waters of the ocean, with their mean height and depth.

It is at once evident that the data for any very accurate computation are not available, yet the records of travellers, of deep-sea expeditions, and the hydrographic surveys of various nations have of late years furnished much information for the construction of orographical maps and bathymetrical charts of the world. The following results, although only approximate, will, however, do much to render our ideas more definite; in consequence of these numerical statements, it will be all the more easy to point out those regions in which the estimates are most at fault, and the foundation may thus be laid for still more precise and accurate evaluations.

The available data as to the heights of the land and the depths of the sea have been placed on large maps constructed according to Lambert's Equivalent Surface Projection,[1] and from these contour lines have been drawn, as shown on the accompanying maps, which are reduced from those used in the investigations.[2]

The planimeter was used to ascertain the areas included within the contour lines; the results obtained were then calculated in square miles; the following tables give the general results.

[3] TABLE 1.—Superficial Area of the Land of the Globe at Various Elevations above the Sea.

EUROPE.

(Including the British, Mediterranean, and Baltic Islands.)

Height in Feet.				Square Miles.
Below Sea-level				65,050
Between	0	and	600	1,975,550
,,	600	,,	1,500	991,800
,,	1,500	,,	3,000	362,000
,,	3,000	,,	6,000	205,150
,,	6,000	,,	12,000	62,800
,,	12,000	,,	18,000	6,950
Over			18,000	800
				3,670,100

[1] *Scottish Geographical Magazine*, vol. ii. p. 549.

[2] In the collection of the latest information as to the heights of land, and in the construction of the maps themselves, I have been much indebted for assistance to Mr. J. G. Bartholomew. The depths are taken from the most recent hydrographic charts issued by our own Hydrographic Office, and those of other nations.

[3] These tables give the results of the first of three sets of measurements proposed to be made on four maps with different central points (see Drainage Areas, *Scot. Geog. Mag.*, vol. ii. p. 549). I will be obliged if any one interested in the subject will point out to me errors, or send suggestions as to estimates of areas, heights, or depths.

ASIA.

(Including Ceylon.)

Height in Feet.				Square Miles.
Below Sea-level				232,300
Between	0	and	600	3,817,200
,,	600	,,	1,500	2,603,700
,,	1,500	,,	3,000	3,551,950
,,	3,000	,,	6,000	3,558,200
,,	6,000	,,	12,000	1,635,300
,,	12,000	,,	18,000	826,550
,,	18,000	,,	24,000	135,500
Over			24,000	7,800
				16,368,500

AFRICA.

Height in Feet.				Square Miles.
Below Sea-level				16,300
Between	0	and	600	1,393,750
,,	600	,,	1,500	3,859,850
,,	1,500	,,	3,000	3,066,200
,,	3,000	,,	6,000	2,415,800
,,	6,000	,,	12,000	317,550
,,	12,000	,,	18,000	21,700
Over			18,000	1,600
				11,092,750

NORTH AMERICA.

(Including Newfoundland, the Aleutian Islands, the Arctic Islands, except Greenland, Iceland, Spitzbergen, and Nova Zembla.)

Height in Feet.				Square Miles.
Below Sea-level				3,900
Between	0	and	600	2,462,300
,,	600	,,	1,500	2,450,550
,,	1,500	,,	3,000	1,015,900
,,	3,000	,,	6,000	1,014,750
,,	6,000	,,	12,000	642,700
,,	12,000	,,	18,000	31,800
Over			18,000	1,150
				7,623,050

SOUTH AMERICA.

(Including Tierra del Fuego and Falkland Islands.)

Height in Feet.				Square Miles.
Between	0	and	600	2,725,550
,,	600	,,	1,500	1,842,850
,,	1,500	,,	3,000	1,151,000
,,	3,000	,,	6,000	483,700
,,	6,000	,,	12,000	346,950
,,	12,000	,,	18,000	280,350
Over			18,000	31,000
				6,861,400

AUSTRALIA.

Height in Feet.				Square Miles.
Between	0	and	600	896,300
,,	600	,,	1,500	1,935,700
,,	1,500	,,	3,000	123,900
,,	3,000	,,	6,000	46,500
Over			6,000	11,650
				3,014,050

EAST INDIES.

(Including Sumatra, Java, Borneo, New Guinea, Philippines, Celebes, and smaller islands of Polynesia.)

Height in Feet.				Square Miles.
Between	0	and	600	305,850
,,	600	,,	1,500	185,650
,,	1,500	,,	3,000	282,450
,,	3,000	,,	6,000	255,550
,,	6,000	,,	12,000	59,300
,,	12,000	,,	18,000	2,700
Over			18,000	800
				1,092,300

WEST INDIES.

Height in Feet.				Square Miles.
Between	0	and	600	46,450
,,	600	,,	1,500	42,600
,,	1,500	,,	3,000	13,600
,,	3,000	,,	6,000	1,150
Over			6,000	800
				104,600

MADAGASCAR.

Height in Feet.				Square Miles.
Between	0	and	600	73,600
,,	600	,,	1,500	27,100
,,	1,500	,,	3,000	42,600
,,	3,000	,,	6,000	60,000
Over			6,000	17,400
				220,700

NEW ZEALAND.

Height in Feet.				Square Miles.
Between	0	and	600	15,550
,,	600	,,	1,500	34,850
,,	1,500	,,	3,000	34,900
,,	3,000	,,	6,000	18,600
,,	6,000	,,	12,000	4,700
Over			12,000	1,550
				110,150

JAPAN.

Height in Feet.				Square Miles.
Between	0	and	600	11,600
,,	600	,,	1,500	73,550
,,	1,500	,,	3,000	50,300
,,	3,000	,,	6,000	4,300
,,	6,000	,,	12,000	1,150
Over			12,000	400
				141,300

FORMOSA.

Height in Feet.				Square Miles.
Between	0	and	600	1,950
,,	600	,,	1,500	11,600
,,	1,500	,,	3,000	3,900
,,	3,000	,,	6,000	1,950
,,	6,000	,,	12,000	1,950
Over			12,000	800
				22,150

SAGHALIEN.

Height in Feet.				Square Miles.
Between	0	and	600	1,950
,,	600	,,	1,500	21,300
,,	1,500	,,	3,000	9,750
Over			3,000	9,600
				42,600

GREENLAND.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	143,300
,,	1,500 ,,	3,000	. . . .	147,150
,,	3,000 ,,	6,000	. . . .	619,400
Over		6,000	. . . .	4,700
				914,550

NOVA ZEMBLA.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	11,600
,,	1,500 ,,	3,000	. . . .	7,750
Over		3,000	. . . .	16,300
				35,650

SPITZBERGEN.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	.....
,,	600 ,,	1,500	. . . .	27,100
,,	1,500 ,,	3,000	. . . .	3,500
Over		3,000	. . . .	400
				31,000

ICELAND.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	7,750
,,	600 ,,	1,500	. . . .	7,750
,,	1,500 ,,	3,000	. . . .	11,600
,,	3,000 ,,	6,000	. . . .	6,950
Over		6,000	. . . .	800
				34,850

TASMANIA.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	11,600
,,	600 ,,	1,500	. . . .	13,550
,,	1,500 ,,	3,000	. . . .	3,900
Over		3,000	. . . .	1,950
				31,000

SUMMARY.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	13,746,950
,,	600 ,,	1,500	. . . .	14,284,400
,,	1,500 ,,	3,000	. . . .	9,882,350
,,	3,000 ,,	6,000	. . . .	8,720,250
,,	6,000 ,,	12,000	. . . .	3,107,750
,,	12,000 ,,	18,000	. . . .	1,172,800
,,	18,000 ,,	24,000	. . . .	170,850
Over		24,000	. . . .	7,800
				51,093,150
Below Sea-level			. . . . .	317,550
				51,410,700

From the above tables we arrive at the following percentages for the areas of land in the different zones of height:—

Height in Feet.				Percentages.
Below Sea-level			. . . . .	0·618
Between	0 and	600	. . . .	26·741
,,	600 ,,	1,500	. . . .	27·784
,,	1,500 ,,	3,000	. . . .	19·222
,,	3,000 ,,	6,000	. . . .	16·962
,,	6,000 ,,	12,000	. . . .	6·045
,,	12,000 ,,	18,000	. . . .	2·281
,,	18,000 ,,	24,000	. . . .	0·332
Over		24,000	. . . .	0·015
				100·000

It thus appears that over 54 per cent. of the land lies between the sea-level and 1500 feet; over 36 per cent. between 1500 and 6000 feet; while over 6000 feet there is less than 9 per cent. This is without taking into consideration land which may exist in the Arctic and Antarctic regions. I have elsewhere given reasons for supposing that the Antarctic Continent should be estimated at about 3,500,000 square miles, while the unknown Arctic regions should be regarded as occupied by the waters of the ocean.[1]

The following Table (2.), showing the area and height of land in each ten degrees of latitude north and south of the Equator, brings out some

[1] *Scottish Geographical Magazine*, vol. ii. pp. 527 and 548.

interesting facts, especially with reference to the large amount of land at a high level between the Equator and 40° north latitude.

TABLE 2.—Superficial Area of the Land of the Globe at different Elevations and between each Ten Degrees of Latitude.

LATITUDES 80°—90° N.

Height in Feet.				Square Miles.
Between	0 and	600	.....	.....
,,	600 ,,	1,500	.....	31,000
,,	1,500 ,,	3,000	.....	23,250
Over		3,000	.....	58,050
				112,300

LATITUDES 70°—80° N.

Height in Feet.				Square Miles.
Between	0 and	600	.....	535,400
,,	600 ,,	1,500	.....	314,350
,,	1,500 ,,	3,000	.....	82,900
,,	3,000 ,,	6,000	.....	441,750
Over		6,000	.....	4,700
				1,379,100

LATITUDES 60°—70° N.

Height in Feet.				Square Miles.
Between	0 and	600	.....	2,357,650
,,	600 ,,	1,500	.....	1,362,800
,,	1,500 ,,	3,000	.....	762,650
,,	3,000 ,,	6,000	.....	272,550
,,	6,000 ,,	12,000	.....	9,000
Over		12,000	.....	1,950
				4,766,600

LATITUDES 50°—60° N.

Height in Feet.				Square Miles.
Below Sea-level			.....	3,100
Between	0 and	600	.....	1,974,400
,,	600 ,,	1,500	.....	1,583,400
,,	1,500 ,,	3,000	.....	774,250
,,	3,000 ,,	6,000	.....	754,900
,,	6,000 ,,	12,000	.....	205,950
Over		12,000	.....	3,900
				5,299,900

LATITUDES 40°—50° N.

Height in Feet.				Square Miles.
Below Sea-level				220,700
Between	0 and	600		1,453,700
,,	600 ,,	1,500		1,457,600
,,	1,500 ,,	3,000		1,025,500
,,	3,000 ,,	6,000		1,382,500
,,	6,000 ,,	12,000		605,900
,,	12,000 ,,	18,000		71,650
Over	,,	18,000		7,750
				6,225,300

LATITUDES 30°—40° N.

Height in Feet.				Square Miles.
Below Sea-level				85,200
Between	0 and	600		1,037,600
,,	600 ,,	1,500		960,100
,,	1,500 ,,	3,000		1,149,850
,,	3,000 ,,	6,000		1,337,550
,,	6,000 ,,	12,000		1,107,250
,,	12,000 ,,	18,000		646,500
,,	18,000 ,,	24,000		108,400
Over		24,000		3,900
				6,436,350

LATITUDES 20°—30° N.

Height in Feet.				Square Miles.
Below Sea-level				7,750
Between	0 and	600		1,078,200
,,	600 ,,	1,500		1,757,600
,,	1,500 ,,	3,000		1,409,250
,,	3,000 ,,	6,000		979,550
,,	6,000 ,,	12,000		379,450
,,	12,000 ,,	18,000		138,250
,,	18,000 ,,	24,000		19,350
Over		24,000		3,900
				5,773,300

LATITUDES 10°—20° N.

Height in Feet.				Square Miles.
Below Sea-level				800
Between	0 and	600		720,150
,,	600 ,,	1,500		1,643,450
,,	1,500 ,,	3,000		1,263,250
,,	3,000 ,,	6,000		519,550
,,	6,000 ,,	12,000		118,150
Over		12,000		12,750
				4,278,100

LATITUDES 0°—10° N.

Height in Feet.				Square Miles.
Between	0	and	600	747,250
,,	600	,,	1,500	1,134,150
,,	1,500	,,	3,000	1,062,550
,,	3,000	,,	6,000	667,900
,,	6,000	,,	12,000	208,400
,,	12,000	,,	18,000	10,850
Over			18,000	800
				3,831,900

LATITUDES 0°—10° S.

Height in Feet.				Square Miles.
Between	0	and	600	1,494,350
,,	600	,,	1,500	847,850
,,	1,500	,,	3,000	642,650
,,	3,000	,,	6,000	805,250
,,	6,000	,,	12,000	127,000
,,	12,000	,,	18,000	51,500
Over			18,000	4,700
				3,973,300

LATITUDES 10°—20° S.

Height in Feet.				Square Miles.
Between	0	and	600	729,900
,,	600	,,	1,500	979,550
,,	1,500	,,	3,000	855,600
,,	3,000	,,	6,000	778,200
,,	6,000	,,	12,000	133,950
,,	12,000	,,	18,000	140,950
Over			18,000	11,600
				3,629,750

LATITUDES 20°—30° S.

Height in Feet.				Square Miles.
Between	0	and	600	785,950
,,	600	,,	1,500	1,440,150
,,	1,500	,,	3,000	634,950
,,	3,000	,,	6,000	462,650
,,	6,000	,,	12,000	127,350
,,	12,000	,,	18,000	87,550
Over			18,000	11,600
				3,550,200

LATITUDES 30—40° S.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	720,100
,,	600 ,,	1,500	. . . .	561,400
,,	1,500 ,,	3,000	. . . .	123,950
,,	3,000 ,,	6,000	. . . .	189,000
,,	6,000 ,,	12,000	. . . .	53,150
,,	12,000 ,,	18,000	. . . .	7,750
Over		18,000	. . . .	3,900
				1,659,250

LATITUDES 40°—50° S.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	96,800
,,	600 ,,	1,500	. . . .	168,400
,,	1,500 ,,	3,000	. . . .	62,000
,,	3,000 ,,	6,000	. . .	56,200
,,	6,000 ,,	12,000	. . . .	23,250
Over		12,000	. . . .	1,550
				408,200

LATITUDES 50°—60° S.

Height in Feet.				Square Miles.
Between	0 and	600	. . . .	15,500
,,	600 ,,	1,500	. . . .	42,600
,,	1,500 ,,	3,000	. . . .	19,350
,,	3,000 ,,	6,000	. . . .	6,600
Over		6,000	. . . .	3,100
				87,150

LATITUDES 60°—90° S.

	quare Miles.
Antarctic Continent	3,565,550

II.—The Area of the Floor of the Ocean at Various Depths below the Level of the Sea.

In considering the extent of the various areas of the floor of the ocean at different levels beneath the surface of the sea, the same methods have been employed as in estimating the height and areas of the dry land.

In the following table, fathoms are used for indicating the contour lines, yet these are drawn at the same distances apart, as in the case of the land—100 fathoms being equal to 600 feet, 500 equal to 3000 feet, 1000 equal to 6000 feet; the line of 250 fathoms, corresponding to 1500 feet, is, however, omitted.

TABLE 3.

NORTH ATLANTIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	1,068,500
,,	100	,,	500	735,550
,,	500	,,	1,000	534,250
,,	1,000	,,	2,000	3,391,300
,,	2,000	,,	3,000	7,332,400
,,	3,000	,,	4,000	1,273,700
Over			4,000	7,750
				14,343,450

SOUTH ATLANTIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	402,600
,,	100	,,	500	278,700
,,	500	,,	1,000	178,100
,,	1,000	,,	2,000	1,366,600
,,	2,000	,,	3,000	6,883,300
Over			3,000	1,084,000
				10,193,300

GULF OF MEXICO.

Fathoms.				Square Miles.
Between	0	and	100	247,750
,,	100	,,	500	151,000
,,	500	,,	1,000	69,700
,,	1,000	,,	2,000	189,700
Over			2,000	58,050
				716,200

CARIBBEAN SEA.

Fathoms.				Square Miles.
Between	0	and	100	147,100
,,	100	,,	500	212,950
,,	500	,,	1,000	193,550
,,	1,000	,,	2,000	383,250
,,	2,000	,,	3,000	216,800
Over			3,000	7,750
				1,161,400

NORTH SEA.

Fathoms.				Square Miles.
Between	0	and	100	154,850
Over			100	7,750
				162,600

ENGLISH CHANNEL.

Fathoms.			Square Miles.
Between	0 and	100	30,950

BALTIC SEA.

Fathoms.			Square Miles.
Between	0 and	100	189,700
Over		100	5,800
			195,500

MEDITERRANEAN SEA.

Fathoms.			Square Miles.
Between	0 and	100	201,300
,,	100 ,,	500	251,650
,,	500 ,,	1,000	81,300
,,	1,000 ,,	2,000	263,250
Over		2,000	15,500
			813,000

BLACK SEA and SEA OF AZOV.

Fathoms.			Square Miles.
Between	0 and	100	69,700
,,	100 ,,	500	23,200
,,	500 ,,	1,000	7,750
Over		1,000	38,700
			139,350

NORWEGIAN SEA.

Fathoms.			Square Miles.
Between	0 and	100	154,850
,,	100 ,,	500	332,950
,,	500 ,,	1,000	185,800
,,	1,000 ,,	2,000	437,450
Over		2,000	15,500
			1,126,550

ARCTIC OCEAN.[1]

(Excluding Norwegian Sea, and including Hudson's Bay.)

Fathoms.			Square Miles.
Between	0 and	100	1,195,300
,,	100 ,,	500	1,195,350
,,	500 ,,	1,000	1,195,250
Over		1,000	1,195,250
			4,781,150

[1] See note on p. 18.

INDIAN OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	840,100
,,	100	,,	500	762,650
,,	500	,,	1,000	503,300
,,	1,000	,,	2,000	1,595,000
,,	2,000	,,	3,000	13,344,600
Over			3,000	38,700
				17,084,350

RED SEA.

Fathoms.				Square Miles.
Between	0	and	100	61,950
,,	100	,,	500	46,450
,,	500	,,	1,000	48,400
Over			1,000	1,950
				158,750

PERSIAN GULF.

Fathoms.				Square Miles.
Between	0	and	100	77,450

NORTH PACIFIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	437,450
,,	100	,,	500	286,500
,,	500	,,	1,000	309,700
,,	1,000	,,	2,000	1,792,450
,,	2,000	,,	3,000	22,364,900
,,	3,000	,,	4,000	1,420,800
Over			4,000	92,900
				26,704,700

SOUTH PACIFIC OCEAN.

Fathoms.				Square Miles.
Between	0	and	100	232,300
,,	100	,,	500	518,750
,,	500	,,	1,000	731,700
,,	1,000	,,	2,000	4,262,350
,,	2,000	,,	3,000	17,119,200
Over			3,000	739,450
				23,603,750

BEHRING SEA.

Fathoms.			Square Miles.
Between	0 and	100	383,250
,,	100 ,,	500	77,450
,,	500 ,,	1,000	54,200
Over		1,000	344,550
			859,450

SEA OF OKOTSK.

Fathoms.			Square Miles.
Between	0 and	100	181,950
,,	100 ,,	500	189,700
Over		500	170,350
			542,000

SEA OF JAPAN.

Fathoms.			Square Miles.
Between	0 and	100	135,500
,,	100 ,,	500	73,550
,,	500 ,,	1,000	77,450
Over		1,000	89,050
			375,550

YELLOW SEA.

Fathoms.			Square Miles.
Between	0 and	100	371,650
,,	100 ,,	500	92,950
Over		500	3,850
			468,450

CHINA SEA.

Fathoms.			Square Miles.
Between	0 and	100	669,750
,,	100 ,,	500	205,200
,,	500 ,,	1,000	228,400
,,	1,000 ,,	2,000	240,000
Over		2,000	23,250
			1,366,600

CELEBES SEA.

Fathoms.			Square Miles.
Between	0 and	100	34,850
,,	100 ,,	500	23,250
,,	500 ,,	1,000	23,250
,,	1,000 ,,	2,000	30,950
Over		2,000	69,650
			181,950

SULU SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	77,450
,,	100 ,,	500	. . . .	30,950
,,	500 ,,	1,000	. . . .	11,600
,,	1,000 ,,	2,000	. . . .	38,700
Over		2,000	. . . .	15,500
				174,200

BANDA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	58,050
,,	100 ,,	500	. . . .	162,600
,,	500 ,,	1,000	. . . .	73,550
,,	1,000 ,,	2,000	. . . .	92,900
,,	2,000 ,,	3,000	. . . .	29,050
,,	3,000 ,,	4,000	. . . .	3,900
Over		4,000	. . . .	1,950
				422,000

JAVA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	309,700
,,	100 ,,	500	. . . .	49,950
Over		500	. . . .	400
				360,050

ARAFURA SEA.

Fathoms.				Square Miles.
Between	0 and	100	. . . .	487,800
,,	100 ,,	500	. . . .	42,600
,,	500 ,,	1,000	. . . .	23,000
Over		1,000	. . . .	11,600
				565,200

SOUTHERN OCEAN.[1]

(South of Pacific Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	143,250
,,	100 ,,	500	. . . .	178,100
,,	500 ,,	1,000	. . . .	197,450
,,	1,000 ,,	2,000	. . . .	5,017,300
,,	2,000 ,,	3,000	. . . .	4,405,600
Over		3,000	. . . .	336,800
				10,278,500

[1] See note on p. 18.

SOUTHERN OCEAN.[1]
(South of Indian Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	243,900
,,	100 ,,	500	. . . .	116,150
,,	500 ,,	1,000	. . . .	189,700
,,	1,000 ,,	2,000	. . . .	6,298,700
Over		2,000	. . . .	2,524,150
				9,372,600

SOUTHERN OCEAN.
(South of Atlantic Ocean.)

Fathoms.				Square Miles.
Between	0 and	100	. . . .	418,100
,,	100 ,,	500	. . . .	220,650
,,	500 ,,	1,000	. . . .	274,150
,,	1,000 ,,	2,000	. . . .	1,022,050
,,	2,000 ,,	3,000	. . . .	3,244,200
,,	3,000 ,,	4,000	. . . .	1,285,300
Over		4,000	. . . .	42,600
				6,507,750

ANTARCTIC OCEAN.[2]

Fathoms.				Square Miles.
Between	0 and	100	. . . .	1,108,200
,,	100 ,,	500	. . . .	1,108,200
,,	500 ,,	1,000	. . . .	1,108,150
Over		1,000	. . . .	1,108,150
				4,432,700

[1] The Southern Ocean as here defined is that belt of water extending from the Antarctic Circle to the latitude of 40° S., which latitude is looked upon as the southern boundary of the Pacific, Indian, and Atlantic Oceans.

[2] The figures for the Arctic and Antarctic Oceans are obtained by dividing the superficial area equally into the four zones of depth as shown.

SUMMARY.

Showing the Areas of the Chief Sub-divisions of the Ocean.

Ocean.	Square Miles.	Square Miles.
ATLANTIC OCEAN BASIN—		
North Atlantic,	14,343,450	
South Atlantic,	10,193,300	
Gulf of Mexico,	716,200	
Caribbean Sea,	1,161,400	
North Sea,	162,600	
English Channel,	30,950	
Baltic Sea,	195,500	
Mediterranean Sea,	813,000	
Black Sea,	139,350	
Norwegian Sea,	1,126,550	
Arctic Ocean,	4,781,150	
		33,633,450
PACIFIC OCEAN BASIN—		
North Pacific,	26,704,700	
South Pacific,	23,603,750	
Behring Sea,	859,450	
Sea of Okotsk,	542,000	
Sea of Japan,	375,550	
Yellow Sea,	468,450	
China Sea,	1,366,600	
Celebes Sea,	181,950	
Sulu Sea,	174,200	
Banda Sea,	422,000	
Java Sea,	360,050	
Arafura Sea,	565,200	
		55,623,900
INDIAN OCEAN BASIN—		
Indian Ocean,	17,084,350	
Red Sea,	158,750	
Persian Gulf,	77,450	
		17,320,550
SOUTHERN AND ANTARCTIC OCEANS BASIN—		
Southern Ocean (South of Pacific),	10,278,500	
Southern Ocean (South of Indian),	9,372,600	
Southern Ocean (South of Atlantic),	6,507,750	
Antarctic Ocean,	4,432,700	
		30,591,550
		137,199,450

SUMMARY.

Showing the extent of the Areas of the Ocean's Floor at different Levels in each of the Chief Sub-divisions of the Ocean.

Fathoms.	Atlantic Ocean Basin. Sq. Miles.	Pacific Ocean Basin. Sq. Miles.	Indian Ocean Basin. Sq. Miles.	Southern and Antarctic Oceans Basin. Sq. Miles.	Total. Sq. Miles.	Percentages.
Between 0 and 100	3,862,600	3,379,700	979,500	1,913,450	10,135,250	7·387
,, 100 ,, 500	3,194,900	1,753,450	809,100	1,623,100	7,380,550	5·379
,, 500 ,, 1,000	2,445,700	1,707,650	551,700	1,770,150	6,475,200	4·719
,, 1,000 ,, 2,000	7,265,500	6,902,550	1,596,950	13,446,200	29,211,200	21·292
,, 2,000 ,, 3,000	14,521,550	39,621,550	13,344,600	10,173,950	77,661,650	56·605
,, 3,000 ,, 4,000	2,365,150	2,164,150	38,700	1,622,100	6,190,400	4·512
Over 4,000	7,750	94,850		42,600	145,200	0·106
Total, . .	33,663,450	55,623,900	17,320,550	30,591,550	137,199,450	100·000

The contrast between the percentages of the ocean's floor at different depths is interesting when compared with the percentages of the land above sea-level referred to on page 8. Only 17·4 per cent. of the sea-bed is found at depths less than 6000 feet (1000 fathoms), while over 90 per cent. of the land areas is at a less height than 6000 feet above the sea. Again 77·8 per cent. of the floor of the ocean lies between 6000 feet (1000 fathoms), and 18,000 feet (3000 fathoms), and 4·6 per cent. is deeper than 18,000 feet (3000 fathoms). The relatively rapid descent of the sea-bottom in depths between 100 and 1000 fathoms is thus clearly shown in the above tables, only about 10 per cent. of the ocean's bed being found between these depths.

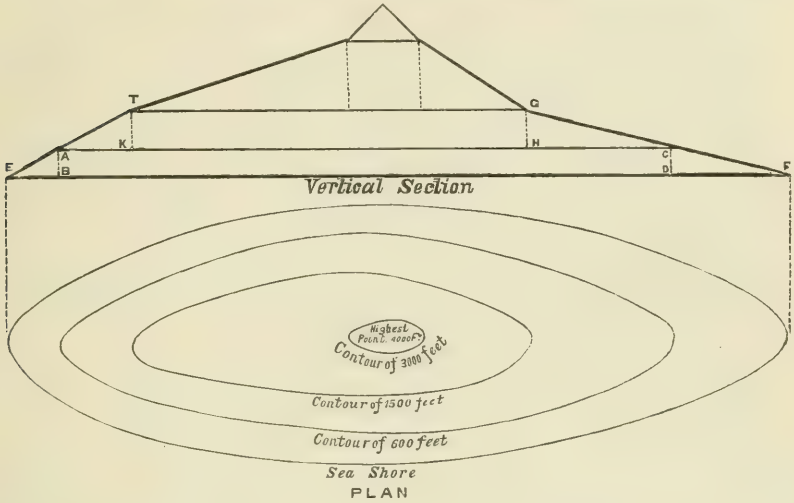
If we regard the abysmal regions as those at greater depths than 6000 feet (1000 fathoms), then according to these measurements they occupy about 113,000,000 square miles of the earth's surface, and the transitional area[1] occupies about 24,000,000 square miles; while the dry land occupies 55,000,000 square miles of the earth's surface.

III.—Bulk and Mean Height of the Land of the Globe.

From the data in the foregoing tables it is possible to estimate approximately the bulk of the land and the volume of the ocean, and thence to calculate the mean height of the one and the mean depth of the other. Let us suppose the annexed diagram to represent a large island or continent. The area between the sea shore and the contour line of 600 feet being known, as also the areas between each of the higher contour lines, then by multiplying the total area within the 600 feet contour (*i.e.* the area of land higher than 600 feet), by 600 feet, we get the cubic contents of a

[1] See Great Ocean Basins, *Nature*, vol. xxxii., pp. 581, 611.

cylindrical mass reaching from a line representing the sea-level to a height of 600 feet, represented by A B D C in the section, and called cylinder in the following tables. In order to obtain the bulk of all the land between the sea-level and 600 feet above it in such an island,



there is still to be added to this cylinder the quoit-like mass surrounding the island, contained between the slope from sea-level to 600 feet, the line of sea-level and the edge of the cylinder—E A B and F C D in the section.

On the supposition that it is a portion of a cone, it is easy to show [1]

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[1] If A_1 and A_2 be the areas of the two ends of any conical frustum (not necessarily a frustum of a circular or other regular cone), and h the height of the frustum, *i.e.* the distance between the two parallel ends, then the volume is accurately given by the formula

$$\tfrac{1}{3}h\{A_1+\sqrt{(A_1A_2)}+A_2\}.$$

Hence, if V denote the volume of the quoit-shaped piece, left after removing the cylinder, whose ends are each A_2, and whose height is h, we have

$$V=\tfrac{1}{3}h\{A_1+\sqrt{(A_1A_2)}-2A_2\},$$
$$=k(A_1-A_2),$$

where $$k=\tfrac{1}{3}h(A_1+\sqrt{(A_1A_2)}-2A_2)/(A_1-A_2).$$

Here k is the linear magnitude by which we must multiply the area of the base of the quoit to get its volume.

Now
$$k=\tfrac{1}{3}h\{A_1-A_2+\sqrt{(A_1A_2)}-A_2\}/(A_1-A_2),$$
$$=\tfrac{1}{3}h\{1+\sqrt{A_2}(\sqrt{A_1}-\sqrt{A_2})/(A_1-A_2)\},$$
$$=\tfrac{1}{3}h\{1+\sqrt{A_2}/(\sqrt{A_1}+\sqrt{A_2})\},$$
$$=\tfrac{1}{3}h\{1+c/(c+1)\},$$

where $$c=\sqrt{A_2}/\sqrt{A_1}.$$

Hence
$$k=h(1+2c)/3(1+c),$$
$$k/h=(1+2c)/3(1+c).$$

This last formula shows that, if c be very small—that is to say, if the aperture of the quoit be very small compared with the area of its outer (lower) rim, the ratio of k to h approaches 1/3. If, on the other hand, c be very nearly equal to unity—that is, if the aperture of the quoit be nearly equal to the area of its outer rim, the ratio k to h approaches 1/2.

that the volume of this quoit-like mass can be obtained by multiplying the area of its base by a number which will never be greater than a half, and never less than a third, of the height. The greater the area of the base the more nearly will one-third the height give a correct result, while the less the area between the two contour lines the more nearly will one-half the height into the area of the base represent the true volume. In other words, the height to be taken depends on the ratio between the total areas included within these upper and lower contour lines. Such a uniformity as we have above supposed in the slope of the land nowhere exists in nature, yet by taking one-third the height it is probable that we will not be far from the truth in estimating the volume of this region. The valleys and hills existing between contours render any exact estimate out of the question. It is probable that in the zones below 3000 feet one-third the height will give results near, but probably below, the truth, while above 3000 feet (where only about a quarter of the area of the land is found) it may not be too high a number. Lapparent uses one-half the height in estimating the region between sea-level and 600 feet, having regard in adopting this number to the many regions where the sea is faced by high cliffs. We might present the matter at present under consideration to ourselves thus:—Suppose a great many lines drawn from the sea-shore to a contour line of 600 feet surrounding an island or continent, these lines would pass through hills in some cases, and over valleys in other instances, and the question is, would the land cut off by or above these lines be sufficient to fill up the hollows beneath them?

On the whole, it is unlikely that, in using one-third the height in calculating the contents of the quoit-like segments, too high a number will be arrived at for the bulk of the land; it is probably less than the truth. In the following tables a second estimate is given, in which lower fractions of the height are taken in all the higher zones, and this product is added to the mass of the cylindrical section. The result thus obtained must certainly be regarded as, in all cases, much below the truth. The fractions used in calculating the slope contents are, in the tables, placed in brackets after the products. The cubic contents of the higher zones are found in the same way as described for that below 600 feet. For instance, the area above 1500 feet into 900 feet gives the volume of the cylinder for the zone between 600 feet and 1500 feet, and the area between the contours of 600 and 1500 feet into a third of 900 feet (300) gives the contents of the slope (H G T K + G H C and T K A in the section). The contents of the highest zone are ascertained by multiplying the area by one-third of the height of the highest mountain in that zone above the last contour line. The results for the various larger divisions of land are given in the following tables.

TABLE 4.—Cubic Contents of the Land of the Globe at different Altitudes above the Level of the Sea.

EUROPE. (Highest point, Mount Elbruz, 18,544 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	185,150	74,800 ($\frac{1}{3}$)	56,150 ($\frac{1}{4}$)	259,950	241,300
,, 600 ,, 1,500	108,700	56,350 ($\frac{1}{3}$)	33,800 ($\frac{1}{5}$)	165,050	142,500
,, 1,500 ,, 3,000	78,350	34,300 ($\frac{1}{3}$)	17,150 ($\frac{1}{6}$)	112,600	95,450
,, 3,000 ,, 6,000	40,100	38,850 ($\frac{1}{3}$)	16,700 ($\frac{1}{7}$)	78,950	56,800
,, 6,000 ,,12,000	8,800	23,750 ($\frac{1}{3}$)	8,900 ($\frac{1}{8}$)	32,600	17,750
,, 12,000 ,,18,000	900	2,650 ($\frac{1}{3}$)	900 ($\frac{1}{9}$)	3,550	1,800
Over 18,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{10}$)	50	10
	422,000	230,750	133,610	652,750	555,610

Mean height—First Estimate, 939 feet. Second Estimate, 799 feet.
Below sea-level—area, 65,050 square miles × 25 feet. Minus quantity, 308·00 cubic miles.

ASIA. (Highest point, Mount Everest, 29,002 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	1,399,850	182,000 ($\frac{1}{3}$)	108,450 ($\frac{1}{4}$)	1,581,850	1,508,300
,, 600 ,, 1,500	1,655,950	147,950 ($\frac{1}{3}$)	88,750 ($\frac{1}{5}$)	1,803,900	1,744,750
,, 1,500 ,, 3,000	1,750,900	336,350 ($\frac{1}{3}$)	168,150 ($\frac{1}{6}$)	2,087,250	1,919,050
,, 3,000 ,, 6,000	1,480,100	673,900 ($\frac{1}{3}$)	289,750 ($\frac{1}{7}$)	2,154,000	1,769,900
,, 6,000 ,,12,000	1,102,100	619,400 ($\frac{1}{3}$)	232,300 ($\frac{1}{8}$)	1,721,500	1,334,350
,, 12,000 ,,18,000	162,850	313,100 ($\frac{1}{3}$)	104,250 ($\frac{1}{9}$)	475,900	267,100
,, 18,000 ,,24,000	8,850	51,300 ($\frac{1}{3}$)	15,450 ($\frac{1}{10}$)	60,200	24,300
Over 24,000	.....	2,450 ($\frac{1}{3}$)	700 ($\frac{1}{11}$)	2,450	700
	7,560,600	2,326,450	1,007,800	9,887,050	8,568,450

Mean height—First Estimate, 3189 feet. Second Estimate, 2764 feet.
Below sea-level—area, 232,300 square miles × 25 feet. Minus quantity, 1099·87 cubic miles.

AFRICA. (Highest point, Kilima-njaro, 18,800 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	1,100,300	52,800 ($\frac{1}{3}$)	39,600 ($\frac{1}{4}$)	1,153,050	1,139,850
,, 600 ,, 1,500	992,500	219,300 ($\frac{1}{3}$)	131,600 ($\frac{1}{5}$)	1,211,800	1,124,050
,, 1,500 ,, 3,000	783,100	290,350 ($\frac{1}{3}$)	145,150 ($\frac{1}{6}$)	1,073,450	928,300
,, 3,000 ,, 6,000	193,650	457,500 ($\frac{1}{3}$)	196,750 ($\frac{1}{7}$)	651,200	390,400
,, 6,000 ,,12,000	26,500	120,300 ($\frac{1}{3}$)	45,100 ($\frac{1}{8}$)	146,750	71,600
,, 12,000 ,,18,000	1,800	8,200 ($\frac{1}{3}$)	2,700 ($\frac{1}{9}$)	10,000	4,550
Over 18,000	.....	100 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	100	50
	3,097,850	1,148,550	560,950	4,246,350	3,658,800

Mean height—First Estimate, 2021 feet. Second Estimate, 1741 feet.
Below sea-level—area, 16,300 square miles × 33 feet. Minus quantity, 101·87 cubic miles.

NORTH AMERICA. (Highest point, Mount Wrangel, 20,000 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	585,900	93,300 ($\frac{1}{8}$)	69,950 ($\frac{1}{4}$)	679,150	655,850
,, 600 ,, 1,500	461,100	139,250 ($\frac{1}{3}$)	83,550 ($\frac{1}{5}$)	600,350	544,650
,, 1,500 ,, 3,000	479,950	96,200 ($\frac{1}{5}$)	48,100 ($\frac{1}{6}$)	576,100	528,000
,, 3,000 ,, 6,000	383,300	192,150 ($\frac{1}{2}$)	82,650 ($\frac{1}{7}$)	575,500	465,950
,, 6,000 ,,12,000	37,450	243,450 ($\frac{1}{3}$)	91,300 ($\frac{1}{8}$)	280,900	128,750
,, 12,000 ,,18,000	1,300	12,050 ($\frac{1}{3}$)	4,000 ($\frac{1}{9}$)	13,350	5,300
Over 18,000	.....	150 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	150	50
	1,949,000	776,550	379,600	2,725,500	2,328,550

Mean height—First Estimate, 1888 feet.
Second Estimate, 1613 feet.
Below sea-level—area, 3900 square miles × 100 feet. Minus quantity.
73·86 cubic miles.

SOUTH AMERICA. (Highest point, Mount Aconcagua, 22,415 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	469,950	103,250 ($\frac{1}{5}$)	77,400 ($\frac{1}{6}$)	573,200	547,400
,, 600 ,, 1,500	390,850	104,700 ($\frac{1}{4}$)	62,800 ($\frac{1}{5}$)	495,550	453,650
,, 1,500 ,, 3,000	324,400	109,000 ($\frac{1}{3}$)	54,500 ($\frac{1}{6}$)	433,400	378,900
,, 3,000 ,, 6,000	470,850	91,600 ($\frac{1}{5}$)	39,400 ($\frac{1}{7}$)	562,500	510,250
,, 6,000 ,,12,000	353,800	131,400 ($\frac{1}{3}$)	49,300 ($\frac{1}{8}$)	485,200	403,100
,, 12,000 ,,18,000	35,250	106,200 ($\frac{1}{3}$)	35,350 ($\frac{1}{9}$)	141,400	70,600
Over 18,000	.....	8,650 ($\frac{1}{3}$)	2,600 ($\frac{1}{10}$)	8,650	2,600
	2,045,100	654,800	321,350	2,699,900	2,366,500

Mean height—First Estimate, 2078 feet.
Second Estimate, 1821 feet.

AUSTRALIA. (Highest point, Mount Kosciusko, 7176 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	240,650	33,200 ($\frac{1}{7}$)	25,450 ($\frac{1}{9}$)	273,800	266,100
,, 600 ,, 1,500	31,050	110,000 ($\frac{1}{3}$)	66,000 ($\frac{1}{5}$)	141,000	97,000
,, 1,500 ,, 3,000	16,500	11,700 ($\frac{1}{3}$)	5,850 ($\frac{1}{6}$)	28,250	22,400
,, 3,000 ,, 6,000	6,600	8,800 ($\frac{1}{4}$)	3,800 ($\frac{1}{7}$)	15,450	10,400
Over 6,000	.....	850 ($\frac{1}{3}$)	350 ($\frac{1}{8}$)	850	350
	294,800	164,550	101,450	459,350	396,250

Mean height—First Estimate, 805 feet.
Second Estimate, 694 feet.

EAST INDIES. (Highest point, Mount Schopenhauer, New Guinea, 20,073 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	89,350	11,600 ($\frac{1}{8}$)	8,700 ($\frac{1}{4}$)	100,950	98,050
„ 600 „ 1,500	102,400	10,550 ($\frac{1}{9}$)	6,350 ($\frac{1}{5}$)	112,950	108,700
„ 1,500 „ 3,000	90,450	26,750 ($\frac{1}{3}$)	13,350 ($\frac{1}{6}$)	117,200	103,800
„ 3,000 „ 6,000	35,650	48,400 ($\frac{1}{3}$)	20,800 ($\frac{1}{7}$)	84,050	56,500
„ 6,000 „ 12,000	4,000	22,450 ($\frac{1}{3}$)	8,400 ($\frac{1}{4}$)	26,450	12,400
„ 12,000 „ 18,000	900	1,000 ($\frac{1}{3}$)	350 ($\frac{1}{9}$)	1,950	1,250
Over 18,000	.....	100 ($\frac{1}{3}$)	50 ($\frac{1}{10}$)	100	50
	322,750	120,850	58,000	443,650	380,750

Mean height—First Estimate, 2144 feet.
Second Estimate, 1841 feet.

WEST INDIES. (Highest point, La Tina, 10,300 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	6,600	1,750 ($\frac{1}{3}$)	1,300 ($\frac{1}{4}$)	8,350	7,950
„ 600 „ 1,500	2,650	2,450 ($\frac{1}{3}$)	1,450 ($\frac{1}{5}$)	5,050	4,100
„ 1,500 „ 3,000	550	1,300 ($\frac{1}{3}$)	650 ($\frac{1}{6}$)	1,850	1,200
„ 3,000 „ 6,000	450	200 ($\frac{1}{3}$)	100 ($\frac{1}{7}$)	700	550
Over 6,000	...	200 ($\frac{1}{3}$)	100 ($\frac{1}{8}$)	200	100
	10,250	5,900	3,600	16,150	13,900

Mean height—First Estimate, 816 feet.
Second Estimate, 700 feet.

MADAGASCAR. (Highest point, Mount Ankaratra, 8887 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	16,700	2,800 ($\frac{1}{3}$)	2,100 ($\frac{1}{4}$)	19,500	18,800
„ 600 „ 1,500	20,450	1,550 ($\frac{1}{3}$)	900 ($\frac{1}{5}$)	22,000	21,400
„ 1,500 „ 3,000	22,000	4,050 ($\frac{1}{3}$)	2,000 ($\frac{1}{6}$)	26,050	24,000
„ 3,000 „ 6,000	9,900	11,350 ($\frac{1}{3}$)	4,900 ($\frac{1}{7}$)	21,250	14,750
Over 6,000	.....	3,150 ($\frac{1}{3}$)	1,200 ($\frac{1}{8}$)	3,150	1,200
	69,050	22,900	11,100	91,950	80,150

Mean height—First Estimate, 2199 feet.
Second Estimate, 1917 feet.

NEW ZEALAND. (Highest point, Mount Cook, 12,400 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	10,750	600 ($\frac{1}{3}$)	450 ($\frac{1}{4}$)	11,350	11,200
„ 600 „ 1,500	10,200	1,950 ($\frac{1}{3}$)	1,200 ($\frac{1}{5}$)	12,150	11,350
„ 1,500 „ 3,000	7,050	3,300 ($\frac{1}{3}$)	1,650 ($\frac{1}{6}$)	10,350	8,700
„ 3,000 „ 6,000	3,550	3,500 ($\frac{1}{3}$)	1,500 ($\frac{1}{7}$)	7,100	5,050
„ 6,000 „12,000	1,750	1,800 ($\frac{1}{3}$)	650 ($\frac{1}{8}$)	3,550	2,450
Over 12,000	.....	50 ($\frac{1}{5}$)	10 ($\frac{1}{9}$)	50	10
	33,300	11,200	5,460	44,500	38,760

Mean height—First Estimate, 2134 feet.
Second Estimate, 1859 feet.

JAPAN. (Highest point, Fuzi-Yama, 14,180 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	14,750	450 ($\frac{1}{3}$)	350 ($\frac{1}{4}$)	15,200	15,050
„ 600 „ 1,500	9,550	4,200 ($\frac{1}{3}$)	2,500 ($\frac{1}{5}$)	13,750	12,050
„ 1,500 „ 3,000	1,650	4,750 ($\frac{1}{3}$)	2,350 ($\frac{1}{6}$)	6,400	4,050
„ 3,000 „ 6,000	900	800 ($\frac{1}{3}$)	350 ($\frac{1}{7}$)	1,700	1,250
„ 6,000 „12,000	450	450 ($\frac{1}{3}$)	150 ($\frac{1}{8}$)	900	600
Over 12,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{9}$)	50	10
	27,300	10,700	5,710	38,000	33,010

Mean height—First Estimate, 1420 feet.
Second Estimate, 1235 feet.

FORMOSA. (Highest point, Mount Morrison, 12,847 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	2,300	100 ($\frac{1}{3}$)	50 ($\frac{1}{4}$)	2,400	2,350
„ 600 „ 1,500	1,450	650 ($\frac{1}{5}$)	400 ($\frac{1}{5}$)	2,100	1,850
„ 1,500 „ 3,000	1,350	350 ($\frac{1}{7}$)	200 ($\frac{1}{6}$)	1,700	1,500
„ 3,000 „ 6,000	1,550	350 ($\frac{1}{3}$)	150 ($\frac{1}{4}$)	1,950	1,700
„ 6,000 „12,000	900	750 ($\frac{1}{3}$)	300 ($\frac{1}{8}$)	1,650	1,200
Over 12,000	.....	50 ($\frac{1}{3}$)	10 ($\frac{1}{9}$)	50	10
	7,550	2,250	1,110	9,850	8,610

Mean height—First Estimate, 2341 feet.
Second Estimate, 2063 feet.

SAGHALIEN. (Highest point, say 4,000 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	4,600	100 ($\frac{1}{3}$)	50 ($\frac{1}{4}$)	4,700	4,650
,, 600 ,, 1,500	3,300	1,200 ($\frac{1}{3}$)	750 ($\frac{1}{5}$)	4,500	4,000
,, 1,500 ,, 3,000	2,750	900 ($\frac{1}{3}$)	450 ($\frac{1}{6}$)	3,650	3,200
Over 3,000	.....	600 ($\frac{1}{3}$)	250 ($\frac{1}{7}$)	600	250
	10,650	2,800	1,500	13,450	12,100

Mean height—First Estimate, 1667 feet.
Second Estimate, 1505 feet.

GREENLAND. (Highest point, Mount Petermann, 11,400 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	103,950	.....	.....	103,950	103,950
,, 600 ,, 1,500	131,450	8,150 ($\frac{1}{3}$)	4,900 ($\frac{1}{3}$)	139,600	136,350
,, 1,500 ,, 3,000	177,300	13,950 ($\frac{1}{3}$)	6,950 ($\frac{1}{6}$)	191,200	184,250
,, 3,000 ,, 6,000	2,650	117,300 ($\frac{1}{3}$)	50,450 ($\frac{1}{7}$)	120,000	53,100
Over 6,000	.....	1,600 ($\frac{1}{3}$)	700 ($\frac{1}{8}$)	1,600	700
	415,350	141,000	63,000	556,350	478,350

Mean height—First Estimate, 3212 feet.
Second Estimate, 2762 feet.

NOVA ZEMBLA. (Highest point, 3204 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	4,050	.....	.....	4,050	4,050
,, 600 ,, 1,500	4,100	650 ($\frac{1}{3}$)	400 ($\frac{1}{5}$)	4,750	4,500
,, 1,500 ,, 3,000	4,650	750 ($\frac{1}{3}$)	350 ($\frac{1}{6}$)	5,400	5,000
Over 3,	...	200 ($\frac{1}{3}$)	100 ($\frac{1}{7}$)	200	100
	12,800	1,600	850	14,400	13,650

Mean height—First Estimate, 2130 feet.
Second Estimate, 2019 feet.

SPITZBERGEN. (Highest point, Schwartz-Spitz, 4399 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	3,500	.....	.....	3,500	3,500
„ 600 „ 1,500	650	1,550 ($\frac{1}{3}$)	950 ($\frac{1}{5}$)	2,200	1,600
„ 1,500 „ 3,000	150	300 ($\frac{1}{3}$)	150 ($\frac{1}{6}$)	450	300
Over 3,000	.. ...	50 ($\frac{1}{3}$)	10 ($\frac{1}{7}$)	50	10
	4,300	1,900	1,110	6,200	5,410

Mean height—First Estimate, 1057 feet
Second Estimate, 921 feet.

ICELAND. (Highest point, Oraefa Jokul, 6408 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	3,100	300 ($\frac{1}{3}$)	250 ($\frac{1}{4}$)	3,350	3,300
„ 600 „ 1,500	3,300	400 ($\frac{1}{3}$)	250 ($\frac{1}{5}$)	3,750	3,550
„ 1,500 „ 3,000	2,200	1,100 ($\frac{1}{3}$)	550 ($\frac{1}{6}$)	3,300	2,750
„ 3,000 „ 6,000	450	1,300 ($\frac{1}{3}$)	550 ($\frac{1}{7}$)	1,750	1,000
Over 6,000	...	50 ($\frac{1}{5}$)	10 ($\frac{1}{8}$)	50	10
	9,050	3,150	1,610	12,200	10,610

Mean height—First Estimate, 1849 feet.
Second Estimate, 1612 feet.

TASMANIA. (Highest point, Cradle Mountain, 5069 feet.)

Height in Feet.	Contents of Cylinder. Cubic Miles.	Contents of Slope. Cubic Miles.		Total Contents. Cubic Miles.	
		First Estimate.	Second Estimate.	First Estimate.	Second Estimate.
Between 0 and 600	2,200	450 ($\frac{1}{3}$)	350 ($\frac{1}{4}$)	2,650	2,550
„ 600 „ 1,500	1,000	800 ($\frac{1}{5}$)	450 ($\frac{1}{6}$)	1,750	1,450
„ 1,500 „ 3,000	550	350 ($\frac{1}{7}$)	200 ($\frac{1}{8}$)	950	750
Over 3,000	.....	250 ($\frac{1}{3}$)	100 ($\frac{1}{7}$)	250	100
	3,750	1,850	1,100	5,600	4,850

Mean height—First Estimate, 1068 feet.
Second Estimate, 925 feet.

SUMMARY.

Continent.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Mean Height. (By First Estimate.)
Europe,	652,750	555,610	939 feet
Asia,	9,887,050	8,568,450	3189 ,,
Africa,	4,246,350	3,658,800	2021 ,,
North America,	2,725,500	2,328,550	1888 ,,
South America,	2,699,900	2,366,500	2078 ,,
Australia,	459,350	396,250	805 ,,
East Indies,	443,650	380,750	2144 ,,
West Indies,	16,150	13,900	816 ,,
Madagascar,	91,950	80,150	2199 ,,
New Zealand,	44,500	38,760	2134 ,,
Japan,	38,000	33,010	1420 ,,
Formosa,	9,850	8,610	2341 ,,
Saghalien,	13,450	12,100	1667 ,,
Greenland,	556,350	478,350	3212 ,,
Nova Zembla,	14,400	13,650	2130 ,,
Spitzbergen,	6,200	5,410	1057 ,,
Iceland,	12,200	10,610	1849 ,,
Tasmania,	5,600	4,850	1068 ,,
	21,923,200	18,954,310	

Mean height—First Estimate, 2252 feet.
Second Estimate, 1947 feet.

SUMMARY.

Height in Feet.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Percentage. (By First Estimate.)
0— 600	4,801,000	4,634,200	21·900
600— 1,500	4,742,250	4,417,650	21·631
1,500— 3,000	4,679,550	4,211,650	21·345
3,000— 6,000	4,277,050	3,338,150	19·509
6,000—12,000	2,705,300	1,974,410	12·340
12,000—18,000	646,350	350,600	2·948
18,000—24,000	69,200	21,000	0·316
Over 24,000	2,450	650	0·011
	21,923,150	18,954,310	100·000
Antarctic Continent,[1]	1,520,700	1,314,750	
	23,443,850	20,269,060	

From the above we find that 84 per cent. of the bulk of the land of the globe lies between the sea-level and a height of 6000 feet, while about 16 per cent. is met with above that height.

[1] These figures are obtained from the estimated area of the Antarctic Continent and the estimated mean height of the land of the Globe, but the Antarctic land is probably higher from the accumulation of snow and ice.

IV.—The Volume of the Ocean at Different Depths beneath the Surface.

The volume of the waters of the ocean has been calculated in the same way as the volume of the dry land at different levels. In the case of the sea, however, in calculating the volume of the slope (quoit-like segments) one-half the depth has been taken in the zones 0 to 100 fathoms (0 to 600 feet), and 100 to 500 fathoms (600 to 3,000 feet), and two-thirds of the depth for all the other zones. The reason for this is obvious, for just as the slope of the land increases as we approach mountains, so does the slope in general decrease as we get into deeper water.

TABLE 5.

NORTH ATLANTIC OCEAN. (Greatest depth, 4561 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,508,500	60,700 ($\frac{1}{2}$)	1,569,200
„ 100 „ 500	5,699,400	167,150 ($\frac{1}{2}$)	5,866,550
„ 500 „ 1000	6,820,850	202,350 ($\frac{2}{3}$)	7,023,200
„ 1000 „ 2000	9,788,100	2,569,100 ($\frac{2}{3}$)	12,357,200
„ 2000 „ 3000	1,456,100	5,554,700 ($\frac{2}{3}$)	7,010,800
„ 3000 „ 4000	8,800	964,900 ($\frac{2}{3}$)	973,700
Over 4000	...	3,300 ($\frac{2}{3}$)	3,300
	25,281,750	9,522,200	34,803,950

Mean depth—2135 fathoms.

SOUTH ATLANTIC OCEAN. (Greatest depth, 3100 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,112,550	22,900 ($\frac{1}{2}$)	1,135,450
„ 100 „ 500	4,323,500	63,350 ($\frac{1}{2}$)	4,386,850
„ 500 „ 1000	5,303,200	67,450 ($\frac{2}{3}$)	5,370,650
„ 1000 „ 2000	9,053,500	1,035,250 ($\frac{2}{3}$)	10,088,750
„ 2000 „ 3000	1,231,800	5,214,450 ($\frac{2}{3}$)	6,446,250
Over 3000	...	82,150 ($\frac{2}{3}$)	82,150
	21,024,550	6,485,550	27,510,100

Mean depth—2375 fathoms.

GULF OF MEXICO. (Greatest depth, 2119 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	53,250	14,100 ($\frac{1}{3}$)	67,300
„ 100 „ 500	144,300	34,300 ($\frac{1}{2}$)	178,600
„ 500 „ 1000	140,750	26,400 ($\frac{2}{3}$)	167,150
„ 1000 „ 2000	65,950	143,700 ($\frac{2}{3}$)	209,700
Over 2000	...	5,250 ($\frac{2}{3}$)	5,250
	404,250	223,750	628,000

Mean depth—772 fathoms.

CARIBBEAN SEA. (Greatest depth, 3169 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	115,250	8,350 ($\frac{1}{3}$)	123,600
„ 100 „ 500	364,250	48,400 ($\frac{1}{2}$)	412,650
„ 500 „ 1000	345,350	73,300 ($\frac{2}{3}$)	418,650
„ 1000 „ 2000	255,150	290,350 ($\frac{2}{3}$)	545,500
„ 2000 „ 3000	8,800	164,600 ($\frac{2}{3}$)	173,400
Over 3000	...	1,000 ($\frac{2}{3}$)	1,000
	1,088,800	586,000	1,674,800

Mean depth—1269 fathoms.

NORTH SEA. (Greatest depth, 360 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	900	8,800 ($\frac{1}{2}$)	9,700
Over 100	...	1,500 ($\frac{1}{2}$)	1,500
	900	10,300	11,200

Mean depth—61 fathoms.

ENGLISH CHANNEL. (Greatest depth, 86 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	...	1,500 ($\frac{1}{2}$)	1,500

Mean depth—43 fathoms.

BALTIC SEA. (Greatest depth, 430 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	700	10,750 ($\frac{1}{2}$)	11,450
Over 100	...	1,100 ($\frac{1}{2}$)	1,100
	700	11,850	12,550

Mean depth—57 fathoms.

MEDITERRANEAN SEA. (Greatest depth, 2150 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	69,500	11,450 ($\frac{1}{2}$)	80,950
„ 100 „ 500	163,650	57,200 ($\frac{1}{9}$)	220,850
„ 500 „ 1000	158,400	30,800 ($\frac{2}{3}$)	189,200
„ 1000 „ 2000	17,600	199,450 ($\frac{2}{3}$)	217,050
Over 2000	...	1,750 ($\frac{2}{3}$)	1,750
	409,150	300,650	709,800

Mean depth—768 fathoms.

BLACK SEA. (Greatest depth, 1070 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	7,900	3,950 ($\frac{1}{2}$)	11,850
„ 100 „ 500	21,100	5,300 ($\frac{1}{4}$)	26,400
„ 500 „ 1000	22,000	2,950 ($\frac{2}{3}$)	24,950
Over 1000	...	2,000 ($\frac{2}{3}$)	2,000
	51,000	14,200	65,200

Mean depth—412 fathoms.

NORWEGIAN SEA. (Greatest depth, 2005 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	110,400	8,800 ($\frac{1}{9}$)	119,200
„ 100 „ 500	290,350	75,650 ($\frac{1}{4}$)	366,000
„ 500 „ 1000	257,350	70,400 ($\frac{2}{3}$)	327,750
„ 1000 „ 2000	17,600	331,400 ($\frac{2}{3}$)	349,000
Over 2000	...	50 ($\frac{2}{3}$)	50
	675,700	486,300	1,162,000

Mean depth—908 fathoms.

ARCTIC OCEAN. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	407,450	67,900 ($\frac{1}{2}$)	475,350
,, 100 ,, 500	1,086,550	271,650 ($\frac{1}{4}$)	1,358,200
,, 500 ,, 1000	679,100	452,700 ($\frac{2}{3}$)	1,131,800
Over 1000	...	452,700 ($\frac{2}{3}$)	452,700
	2,173,100	1,244,950	3,418,050

Mean depth—630 fathoms.

INDIAN OCEAN. (Greatest depth, 3097 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,845,850	47,750 ($\frac{1}{2}$)	1,893,600
,, 100 ,, 500	7,037,050	173,300 ($\frac{1}{4}$)	7,210,350
,, 500 ,, 1000	8,510,000	190,650 ($\frac{2}{3}$)	8,700,650
,, 1000 ,, 2000	15,207,500	1,208,300 ($\frac{2}{3}$)	16,415,800
,, 2000 ,, 3000	44,000	10,109,550 ($\frac{2}{3}$)	10,153,550
Over 3000	...	2,850 ($\frac{2}{3}$)	2,850
	32,644,400	11,732,400	44,376,800

Mean depth—2286 fathoms.

RED SEA. (Greatest depth, 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	3,500 ($\frac{1}{2}$)	14,500
,, 100 ,, 500	22,900	10,550 ($\frac{1}{4}$)	33,450
,, 500 ,, 1000	1,100	18,350 ($\frac{2}{3}$)	19,450
Over 1000	...	300 ($\frac{2}{3}$)	300
	35,000	32,700	67,700

Mean depth—375 fathoms.

PERSIAN GULF. (Greatest depth, say 50 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	...	2,200 ($\frac{1}{2}$)	2,200

Mean depth—25 fathoms.

NORTH PACIFIC OCEAN. (Greatest depth, 5000 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	2,984,800	24,850 ($\frac{1}{2}$)	3,009,650
,, 100 ,, 500	11,809,200	65,100 ($\frac{1}{2}$)	11,874,300
,, 500 ,, 1000	14,585,400	117,300 ($\frac{2}{3}$)	14,702,700
,, 1000 ,, 2000	27,134,450	1,357,850 ($\frac{3}{3}$)	28,492,300
,, 2000 ,, 3000	1,720,050	16,942,700 ($\frac{3}{3}$)	18,662,750
,, 3000 ,, 4000	105,550	1,076,350 ($\frac{2}{3}$)	1,181,900
Over 4000	...	70,300 ($\frac{3}{3}$)	70,300
	58,339,450	19,654,450	77,993,900

Mean depth—2570 fathoms.

SOUTH PACIFIC OCEAN. (Greatest depth, 3305 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	2,655,700	13,200 ($\frac{1}{3}$)	2,668,900
,, 100 ,, 500	10,387,450	117,900 ($\frac{1}{3}$)	10,505,350
,, 500 ,, 1000	12,568,400	277,150 ($\frac{2}{3}$)	12,845,550
,, 1000 ,, 2000	20,293,750	3,228,950 ($\frac{3}{3}$)	23,522,700
,, 2000 ,, 3000	840,250	12,968,550 ($\frac{3}{3}$)	13,808,800
Over 3000	...	170,850 ($\frac{3}{3}$)	170,850
	46,745,550	16,776,600	63,522,150

Mean depth—2368 fathoms.

BEHRING SEA. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	54,100	21,750 ($\frac{1}{2}$)	75,850
,, 100 ,, 500	181,250	17,600 ($\frac{1}{2}$)	198,850
,, 500 ,, 1000	195,750	20,550 ($\frac{2}{3}$)	216,300
Over 1000	...	130,500 ($\frac{3}{3}$)	130,500
	431,100	190,400	621,500

Mean depth—636 fathoms.

SEA OF OKOTSK. (Greatest depth, say 700 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	40,900	10,350 ($\frac{1}{2}$)	51,250
„ 100 „ 500	77,450	43,100 ($\frac{1}{2}$)	120,550
Over 500	...	25,800 ($\frac{2}{3}$)	25,800
	118,350	79,250	197,600

Mean depth—292 fathoms.

SEA OF JAPAN. (Greatest depth, say 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	27,250	7,700 ($\frac{1}{2}$)	34,950
„ 100 „ 500	75,700	16,700 ($\frac{1}{2}$)	92,400
„ 500 „ 1000	50,600	29,350 ($\frac{2}{3}$)	79,950
Over 1000	...	13,500 ($\frac{2}{3}$)	13,500
	153,550	67,250	220,800

Mean depth—517 fathoms.

YELLOW SEA. (Greatest depth, say 600 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	21,100 ($\frac{1}{2}$)	32,100
„ 100 „ 500	1,500	21,150 ($\frac{1}{2}$)	22,650
Over 500	...	300 ($\frac{3}{3}$)	300
	12,500	42,550	55,050

Mean depth—103 fathoms.

CHINA SEA. (Greatest depth, say 2200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	79,200	38,050 ($\frac{1}{2}$)	117,250
„ 100 „ 500	223,500	46,650 ($\frac{1}{2}$)	270,150
„ 500 „ 1000	149,550	86,500 ($\frac{2}{3}$)	236,050
„ 1000 „ 2000	26,400	181,800 ($\frac{2}{3}$)	208,200
Over 2000	...	3,550 ($\frac{2}{3}$)	3,550
	478,650	356,550	835,200

Mean depth—538 fathoms.

CELEBES SEA. (Greatest depth, 2745 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	16,700	2,000 ($\frac{1}{9}$)	18,700
,, 100 ,, 500	56,300	5,300 ($\frac{1}{9}$)	61,600
,, 500 ,, 1000	57,150	8,800 ($\frac{2}{9}$)	65,950
,, 1000 ,, 2000	79,150	23,450 ($\frac{2}{3}$)	102,600
Over 2000	...	39,300 ($\frac{2}{3}$)	39,300
	209,300	78,850	288,150

Mean depth—1394 fathoms.

SULU SEA. (Greatest depth, say 2200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	11,000	4,400 ($\frac{1}{2}$)	15,400
,, 100 ,, 500	29,900	7,050 ($\frac{1}{2}$)	36,950
,, 500 ,, 1000	30,800	4,400 ($\frac{2}{3}$)	35,200
,, 1000 ,, 2000	17,600	29,300 ($\frac{2}{3}$)	46,900
Over 2000	...	2,350 ($\frac{2}{3}$)	2,350
	89,300	47,500	136,800

Mean depth—691 fathoms.

BANDA SEA. (Greatest depth, say 4200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	41,350	3,300 ($\frac{1}{2}$)	44,650
,, 100 ,, 500	91,550	36,950 ($\frac{1}{2}$)	128,500
,, 500 ,, 1000	72,600	27,850 ($\frac{2}{3}$)	100,450
,, 1000 ,, 2000	39,650	70,400 ($\frac{2}{3}$)	110,050
,, 2000 ,, 3000	6,650	22,000 ($\frac{2}{3}$)	28,650
,, 3000 ,, 4000	2,200	2,950 ($\frac{2}{3}$)	5,150
Over 4000	...	300 ($\frac{2}{3}$)	300
	254,000	163,750	417,750

Mean depth—871 fathoms.

JAVA SEA. (Greatest depth, say 550 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	5,700	17,600 ($\frac{1}{2}$)	23,300
„ 100 „ 500	200	11,350 ($\frac{1}{2}$)	11,550
Over 500	...	50 ($\frac{2}{3}$)	50
	5,900	29,000	34,900

Mean depth—85 fathoms.

ARAFURA SEA. (Greatest depth, 1200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	8,800	27,700 ($\frac{1}{2}$)	36,500
„ 100 „ 500	15,800	9,700 ($\frac{1}{2}$)	25,500
„ 500 „ 1000	6,600	8,800 ($\frac{2}{3}$)	15,400
Over 1000	...	1,750 ($\frac{2}{3}$)	1,750
	31,200	47,950	79,150

Mean depth—123 fathoms.

SOUTHERN OCEAN (South of Pacific). (Greatest depth, say 3200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,151,650	8,150 ($\frac{1}{2}$)	1,159,800
„ 100 „ 500	4,525,850	40,450 ($\frac{1}{2}$)	4,566,300
„ 500 „ 1000	5,545,150	747,900 ($\frac{2}{3}$)	6,293,050
„ 1000 „ 2000	5,388,950	3,800,850 ($\frac{2}{3}$)	9,189,800
„ 2000 „ 3000	382,700	3,337,500 ($\frac{2}{3}$)	3,720,200
Over 3000	...	51,050 ($\frac{2}{3}$)	51,050
	16,994,300	7,985,900	24,980,200

Mean depth—2139 fathoms.

SOUTHERN OCEAN (South of Indian Ocean). (Greatest depth, 2600 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	1,037,350	13,850 ($\frac{1}{2}$)	1,051,200
„ 100 „ 500	4,096,450	26,400 ($\frac{1}{2}$)	4,122,850
„ 500 „ 1000	5,012,800	71,500 ($\frac{2}{3}$)	5,084,300
„ 1000 „ 2000	2,868,200	4,771,600 ($\frac{2}{3}$)	7,639,800
Over 2000	...	1,147,300 ($\frac{2}{3}$)	1,147,300
	13,014,800	6,030,650	19,045,450

Mean depth—1788 fathoms.

SOUTHERN OCEAN (South of Atlantic). (Greatest depth, say 4200 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	692,000	23,750 ($\frac{1}{2}$)	715,750
„ 100 „ 500	2,667,650	50,150 ($\frac{1}{2}$)	2,717,800
„ 500 „ 1000	3,178,400	104,100 ($\frac{2}{3}$)	3,282,500
„ 1000 „ 2000	5,195,400	774,200 ($\frac{2}{3}$)	5,969,600
„ 2000 „ 3000	1,508,950	2,457,650 ($\frac{2}{3}$)	3,966,600
„ 3000 „ 4000	48,400	973,700 ($\frac{2}{3}$)	1,022,100
Over 4000	...	6,450 ($\frac{2}{3}$)	6,450
	13,290,800	4,390,000	17,680,800

Mean depth—2391 fathoms.

ANTARCTIC OCEAN. (Greatest depth, say 1500 fathoms.)

Depth in Fathoms.	Cylinder—Cubic Miles.	Slope—Cubic Miles.	Total Cubic Miles.
Between 0 and 100	377,750	62,950 ($\frac{1}{2}$)	440,700
„ 100 „ 500	1,007,400	251,850 ($\frac{1}{2}$)	1,259,250
„ 500 „ 1000	629,600	419,700 ($\frac{2}{3}$)	1,049,300
Over 1000	...	419,750 ($\frac{2}{3}$)	419,750
	2,014,750	1,154,250	3,169,000

Mean depth—629 fathoms.

SUMMARY.

Showing the Volume of Water in each of the Main Divisions of the Ocean.

Ocean.	Cubic Miles.	Cubic Miles.
ATLANTIC OCEAN BASIN—		
North Atlantic,	34,803,950	
South Atlantic,	27,510,100	
Gulf of Mexico,	628,000	
Caribbean Sea,	1,674,800	
North Sea,	11,200	
English Channel,	1,500	
Baltic Sea,	12,550	
Mediterranean Sea,	709,800	
Black Sea,	65,200	
Norwegian Sea,	1,162,000	
Arctic Ocean,	3,418,050	
		69,997,150
PACIFIC OCEAN BASIN—		
North Pacific,	77,993,900	
South Pacific,	63,522,150	
Behring Sea,	621,500	
Sea of Okotsk,	197,600	
Sea of Japan,	220,800	
Yellow Sea,	55,050	
China Sea,	835,200	
Celebes Sea,	288,150	
Sulu Sea,	136,800	
Banda Sea,	417,750	
Java Sea,	34,900	
Arafura Sea,	79,150	
		144,402,950
INDIAN OCEAN BASIN—		
Indian Ocean,	44,376,800	
Red Sea,	67,700	
Persian Gulf,	2,200	
		44,446,700
SOUTHERN AND ANTARCTIC OCEANS BASIN—		
Southern Ocean (South of Pacific),	24,980,200	
Southern Ocean (South of Indian),	19,045,450	
Southern Ocean (South of Atlantic),	17,680,800	
Antarctic Ocean,	3,169,000	
		64,875,450
Grand Total,		323,722,150

SUMMARY.

Showing the Volume of Water at Different Levels in each of the Main Divisions of the Ocean.

Fathoms.	Atlantic Ocean Basin. Cub. Miles.	Pacific Ocean Basin. Cub. Miles.	Indian Ocean Basin. Cub. Miles.	Southern and Antarctic Oceans Basin. Cub. Miles.	Total. Cub. Miles.	Percentages.
Between 0 and 100	3,605,550	6,128,500	1,910,300	3,367,450	15,011,800	4·637
,, 100 ,, 500	12,818,700	23,348,350	7,243,800	12,666,200	56,076,950	17·324
,, 500 ,, 1000	14,653,350	28,323,700	8,720,100	15,709,150	67,406,300	20·822
,, 1000 ,, 2000	24,221,900	52,628,500	16,416,100	23,218,950	116,485,450	35·982
,, 2000 ,, 3000	13,637,500	32,545,400	10,153,550	8,834,100	65,170,550	20·132
,, 3000 ,, 4000	1,056,850	1,357,900	2,850	1,073,150	3,490,750	1·078
Over 4000	3,300	70,600	...	6,450	80,350	0·025
Total, . .	69,997,150	144,402,950	44,446,700	64,875,450	323,722,150	100·000

Mean depth—2076 fathoms.

The above summary shows that 42 per cent. of the waters of the ocean lie between the surface and a depth of 1000 fathoms (6000 feet), while 84 per cent. of the volume of the dry land lies within the same height above the sea-level. Again, 56 per cent. of the ocean's waters is situated between depths of 6000 and 18,000 feet (1000 and 3000 fathoms); beyond the latter depth there is only about 1 per cent. of the bulk of the ocean.

From the foregoing investigation, then, the area of the dry land is estimated at 55,000,000 square miles, the area of the ocean at 137,200,000 square miles. The bulk of the dry land above the level of the sea is 23,450,000 cubic miles, and the volume of the waters of the ocean is 323,800,000 cubic miles. The mean height of the land is 2250 feet; the mean depth of the whole ocean is 12,480 feet (2080 fathoms).

If now we regard the ocean as divided into two areas by the 1000 fathom line, it will be found that the mean depth of the regions within 1000 fathoms is 2030 feet (338 fathoms), or somewhat less than the mean height of the dry land above the sea. On the other hand, the regions beyond 1000 fathoms in the ocean have a mean depth of 14,640 feet (2440 fathoms).

In a previous paper[1] I have called the former regions the *transitional area* of the earth's surface, and it occupies about 24,000,000 square miles. The latter regions are called the *abyssal area*, and cover 113,000,000 square miles, or more than one-half of the earth's surface, while the general level of this area is fully three miles below the general level of the

[1] *Nature*, vol. xxxii. pp. 581, 611.

THE WORLD

SHOWING HEIGHT OF LAND AND DEPTH OF SEA

ILLUSTRATING Mr. MURRAY'S PAPER

dry land. In the transitional area of the ocean there is a great variety of conditions in regard to light, heat, currents, changes of level, the character and variety of the deposits there forming, and the animals and plants inhabiting the various parts of the region. The deposits are in most respects quite similar to those which make up a very large part of the sedimentary formations of the dry land. In the abysmal area there is a very uniform set of conditions—the temperature is near the freezing-point, and the annual range does not exceed 5° F., there is no sunlight, no plant life. While there is a great abundance of animal life, the forms from various parts of the area are very similar, and unlike those of shallower waters; the deposits, which there accumulate slowly, are not similar to the sedimentary deposits of the dry land.

The annual discharge of nineteen rivers[1] in different parts of the world is estimated at 865 cubic miles of water, and it is further estimated that these carry into the ocean 0·332 of a cubic mile of matter in suspension within the same time. The total annual discharge of rivers from the land of the globe is estimated at 6524 cubic miles, which at the above rate would give 2·5 cubic miles of sediment carried into the ocean each year. To this must be added the matter carried to the sea in solution, which is estimated at 1·183 cubic miles of matter.[2] Together, then, the amount of matter carried from the land each year in suspension and solution is 3·7 cubic miles. It would thus, according to this calculation and rate of degradation, take 6,340,000 years to transport the whole of the solid land down to the sea.

From the above investigation it also appears that if the land of the globe were reduced to the sea level by being removed to and piled up in the shallower waters of the ocean, its extent would then be nearly 80,000,000 square miles, and the rest of the surface of the earth would be covered by an ocean over three miles in depth, extending to about 113,000,000 square miles. Again, should the whole of the solid land be reduced to one level under the ocean, then the surface of the earth would be covered by an ocean with a uniform depth of about two miles.

The volume of the whole sphere is estimated at 259,850,117,778 cubic miles; hence it follows from the foregoing tables that the volume of the ocean is to the volume of the whole sphere as 1 to 800. Regarding the globe as covered by an ocean of a uniform depth of two miles, the ocean would be roughly 1/666 of the whole sphere.

I have been indebted to Professor Chrystal for many suggestions during the preparation of this paper. I desire also to acknowledge the care with which my assistants, Mr. James Chumley and Mr. John Gunn, have checked all the measurements and calculations.

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[1] Ganges, Yangtse-kiang, Yellow River, Pei-ho, Irrawaddi, Hooghley, Tay, Thames, Forth, Clyde, Boyne, Po, Danube, Rhine, Brentna, Durance, Plate, Mississippi, and Amazon.

[2] *Scottish Geographical Magazine*, vol. iii. pp. 76, 77.

THE WELLE PROBLEM.

By J. de Jankó, Jun., of Buda-Pesth.

In consequence of the zealous exploration carried on in Africa during the present century, the appellation *terra incognita*, so long used to designate that continent, is now only applicable to the small portion of territory lying between the sources of the Nile and the Shari, and the Congo north of the equator. This region is watered by the Welle, whose course is only known to the east of the 22d meridian. Its lower portion is still unexplored. The determination of the outlet of this river is the Welle problem.[1] Where does it discharge its waters—into the Shari, the Congo, or elsewhere?

The first European to set eyes upon the Welle was Dr. Schweinfurth,[2] who, agreeably to the state of geographical knowledge at that time, considered it as belonging to the Shari. His main reason for this conclusion was that the great volume of water in the Shari, as observed by Barth,[3] Nachtigal,[4] and others, could only be explained by the existence of some considerable tributary such as this. The water of the Shari, however, is highest when that of the Welle is lowest, namely in March, notwithstanding that the current of the Welle is of sufficient velocity to be able to traverse the distance between the nearest observed points of the two rivers in the space of twenty-two days. Consequently the Welle cannot belong to the system of the Shari. Since Dr. Schweinfurth first visited this region our knowledge of it has very largely increased, and he has now, in the light of this newer information, abandoned his former theory as to the issue of the river, and subscribed to Wauter's view.[5] The identity of the Welle and the Shari is still maintained by Duveyrier.

The lifting of the veil from the course of the Congo has also thrown a different light upon the problem of the Welle. Stanley discovered below Stanley Falls a large river, the Aruwimi,[6] which he subsequently ascended[7] for a distance of 90 miles, and which, on its discovery, he identified with the Welle. After this the Welle was separated from the system of the Shari, and assigned to that of the Congo. This still left the great volume of the Shari unaccounted for. Succeeding explorers of the Congo—Hanssen and Grenfell[8]—discovered several large right-hand tributaries of the Congo, such as the Itimbiri or Ukere, and the Ubangi. These two streams have therefore been brought in to play a *rôle* in con-

[1] Baumann, "Die Uelle-Frage," *Mitt. k. k. Geogr. Ges.*, Vienna, 1885, p. 342.
[2] Schweinfurth, *In the Heart of Africa*, vol. i. ch. xii.
[3] Barth, *Reise in Central Africa*, vol. ii. p. 64.
[4] Nachtigal, *Sahara und Sudan*, chap. *Der Tsad.*
[5] *Verhandl. Ges. Erdk.*, Berlin, 1887, vol. xiv., No. 3.
[6] *Through the Dark Continent*, Asher's edition, vol. iii. p. 354.
[7] *Der Kongo*, vol. ii. p. 132.
[8] *Journ. Manchester Geog. Soc.*, 1886, vol. ii., No. 1, p. 87.

nection with the Welle problem—Chavanne[1] identifying this river with the former, and Wauters[2] and Junker[3] with the latter.

Besides these, there are other bold hypotheses in the field. One of these, that of Andree and Scobel,[4] assigns the Welle neither to the Congo nor to the Shari, but makes it flow into an inland lake without any outlet, which lies, according to Ravenstein, in about 3° N. lat. and 25° E. longitude. Another hypothesis, which owing to its want of critical acumen seems like a survival of the Middle Ages, is due to Lacroix,[5] who holds that the Welle pours itself, not into Escayrac's Koei-Dabo lake, lying sixty days' journey south-west of Massena, but into Lake Liba, from which issue two arms, one going to the Benue, whilst the other reaches the Ogowe. The exploration of the northern tributaries of the Congo has also shown Heawood's hypothesis[6] that the Welle, after a course of 1250 miles, joins the Cross or Old Calabar river, to be untenable.

Summing up these various theories, we seem to be justified in concluding (1) that the Welle, taking into account the rise and fall of its stream, cannot belong to the Shari (Schweinfurth); (2) that it cannot issue into an enclosed lake, for portions of the Welle are known to the west of the geographical position in which the lake in question—that of Andree and Scobel—is supposed to be situated; (3) that it cannot flow into a lake which sends one arm to the Benue and another to the Ogowe, since in that case these arms would have to cross the northern affluents of the Congo and the Ubangi (Lacroix); (4) that, for the same reason, it cannot join the Old Calabar, although this last is large enough to render Heawood's hypothesis probable; (5) that it cannot enter the Aruwimi, for in that case the Welle would have to bend round suddenly from a westerly to a south-easterly direction, as well as to break through a mountain chain, the direction of the Aruwimi, moreover, so far as its course is known, is from east to west with a very slight deflection to the south-south-west (Stanley); (6) that it cannot be identified with the Ukere, at least not in conjunction with the Werre and the Kuta-Mbomu, for that would necessitate these two streams making an exceedingly wide curve to the south-west, and the volume of the Itimbiri (Ukere) is not commensurable with the united volumes of all the rivers in question; (7) that it can hardly pour itself into the Mongalla, since this latter is considerably the smaller in volume (Hanssen).

(8) The eighth hypothesis, that of Wauters, which has the support of Schweinfurth and Junker, makes the Welle identical with the Ubangi. We may remark parenthetically that Delgeurs[7] claimed to be the original

[1] *Afrika's Ströme und Flüsse*, p. 130.
[2] *Mouvement Géographique*, 1885, May 31.
[3] *Verhandl. Ges. Erdk.*, Berlin, 1887, vol. xiv., No. 3.
[4] *Karte von Africa*, 1 : 10,000,000, 1884.
[5] *Bull. Vn. Géogr.*, Lille, 1881, p. 31.
[6] *Roy. Geog. Soc.*, London, 1884, p. 33.
[7] *Bull. Soc. Roy. Géogr.*, Antwerp, 1885, vol. x. No. 3, p. 150.

author of this theory. It must be conceded that, according to the latest information furnished by Junker, the Welle, so far as its direction is concerned, may go to join the Ubangi, also that the rise and fall in the respective volumes of the two rivers agree quite well. Nevertheless we cannot accept this coincidence in the matter of volume as a *sine qua non*. At the point where Schweinfurth first came upon the Welle, it had a width of 800 feet, a depth of 12 to 15 feet, and a current of extraordinary velocity. If now the Werre, a river of the same magnitude as the Welle, and the Kuta-Mbomu, which is of still greater magnitude, added their waters to those of the Welle, the united stream ought to be at least 2500 feet wide, and from 12 to 16 feet deep. This argument takes no account of the fact that the Welle increases rapidly in volume between the point at which Schweinfurth first saw it and the confluence of the Werre and the Kuta-Mbomu. The Ubangi, at the furthest known point of its course, that nearest to the united Welle-Werre-Kuta-Mbomu, is only 1800 feet wide, and from 14 to 16 feet deep; it cannot therefore be identified with the Welle.

That this feature of the question escaped the notice of both Schweinfurth and Junker seems to be due to the fact that neither of them has studied the data relating to the Welle basin so thoroughly as Ravenstein and Habenicht have done. Before proceeding to sketch the hydrographical features of this region, we must first dwell a little upon the history of discovery in connection with the basin of the Welle.

The first explorer to penetrate to this basin was Piaggia,[1] who visited the region as early as 1863. But Schweinfurth was the first traveller to give any authentic information about the river Welle itself. In the years 1876-77 the Greek physician Potagos was travelling in this same region. His information is, however, somewhat uncertain. He discovered a river named the Berre, which, according to the statements of native informants, flowed towards the west, and joined the Kuta-Mbomu; this river Potagos identified with the Welle. Over against the confluence of the Berre with the Kuta-Mbomu lay the George Mountains.[2] It is now conclusively established that the Berre of Potagos is identical, not with Schweinfurth's Welle, but with Miani's Werre,[3] a stream which Miani again concluded to be one and the same with the Welle.

Leaving out of consideration for the moment Junker's latest reports, the knowledge we already possess of the Welle system may be summarised as follows. The region to which that system belongs is wedged in, as already stated, between the three rivers, Nile, Shari, and Congo. The really important factors of the problem are the actual basin of the river Welle itself, and the northern tributaries of the Congo. Going northwards from the banks of the Congo towards the Nile, the traveller would

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[1] *Della Riva fra i Niam-Niam*, Lucca, 1877.

[2] *Dix Années de Voyages dans l'Afrique, etc.*, Paris, 1885, vol. i.

[3] *Le Spedizione alle Origine del Nilo*, Venice, 1865.

have to cross four rivers all flowing for the most part from east to west, namely, the Nepoko, Welle, Werre, and Kuta-Mbomu.

The Nepoko originates between 29° and 30° E. long., and 2° and 3° S. lat., flows south-westwards, and joins the Congo north of Stanley Falls. Junker has touched its banks at two points, and Stanley has during the course of the year 1887 followed it up to its sources. The former traveller also mentions two northern affluents of the Nepoko, the Obe, which he himself saw, and the Nava, which he only knows from oral information of the natives.[1]

The Welle is formed by the union of two large feeders, the Dangu and the Kibali-Kibbi. This last, rising in the Blue Mountains that overlook Lake Albert from the west, takes at first a northerly direction; then, after bending round towards the north-north-west, it joins the Dangu near the line of 28° E. long. Its total length may be set down at from 205 to 220 miles. Casati travelled parallel to its course at only a short distance from its bank. Junker and Emin Pasha have explored the country about its head-waters. The Dangu, which has its origin in 4° N. lat. and 30° E. long., after making a southerly bend, flows towards the west, receiving on its way the Garamba and the Akka. The united stream, under the name of Welle or Makua, rolls on in a prevalent westerly direction, coinciding generally with 4° N. lat. Its most important tributary from the south is the Majo-Bomakandi, which is itself augmented by the Makongo, Pokko, and Telli.

The Werre is fed by numerous springs in the Ndoruma Mountains, and runs successively west, south-west, and west. The furthest point that has been reached on the banks of this river is Ingimma, where Potagos turned back. The Werre has no tributaries of any consequence.

The fourth river, the Kuta-Mbomu, likewise issues from the Ndoruma Mountains, its highest point being in 23° E. long. It maintains a persistent westerly flow, and is joined by some large tributaries from the north.

That portion of the Congo which is concerned in the Welle problem is the northern loop between Stanley Falls and Equatorville. Along this part of its course its current is swollen by the addition of three large tributaries—the Aruwimi, the Itimbiri, and the Ubangi. The first of these three, which joins it in 1° N. lat. and 23° 45′ E. long., is now known throughout its whole distance. From Stanley's latest letters it is evident that it is no other than the Nepoko. Although 1585 yards wide at its mouth, it contracts higher up to a width of only 910 yards; but still higher up, in consequence of the presence of several islands, it expands to 1400 yards wide. Above the islands it maintains a tolerably uniform width of 800 yards. Some sixty miles lower down, in 2° N. lat. and 23° E. long., the Congo receives the Itimbiri, which comes from the north-east, about 150 or 160 miles of its course being known. Early in its

[1] *Peterm. Geog. Mitth.*, 1884, vol. xxx. p. 96.

descent it forms the rapids of Lubi, where it narrows to 195 yards wide, and shallows to some 10 or 12 feet deep; lower down it swells out to a width of 750 to 850 yards, and a depth of 12 to 16 feet. The third tributary of the Congo along this portion of its course, the Ubangi, joins it south of the Equator. It has been ascended for a distance of 600 to 650 miles, as far as 20° 20′ E. long. and 4° 30′ S. lat. At this point navigation is prevented by the rapids; the river has there a width of 660 yards and a depth of 19½ feet; and thence the current runs south-west, then south, following the 18th meridian for a distance of about two degrees of latitude.

Before adding a ninth hypothesis to the eight already ventilated above, we must first consider the results of Junker's last journeys, and compare his map with those of Ravenstein and Habenicht. In doing this, however, we feel bound to state that we are far from desiring to detract from the very valuable labours performed by this enterprising traveller.

On Junker's map the delineation of the river Congo differs very considerably from that shown on Ravenstein's and Habenicht's maps. On the first the Congo is made to touch 20° E. long. to the south of the second parallel north of the Equator; on the last two it touches the same meridian to the north of the same parallel. Compared with Habenicht's trustworthy map, that of Junker represents Iringi, on the left bank of the Congo, as lying at least half a degree more to the west, and in the same direction he transposes the positions of the mouth of the Itimbiri by 10′, the widest and most northerly portion of the Congo by a full degree, and the mouth of the Aruwimi by half a degree. Again, whereas on Junker's map the Congo intersects 24° E. long. southwards of 1° N. lat., Habenicht puts the point of intersection exactly on that parallel. Junker's latest representation of the Welle, too, deviates not only from that depicted on the English and German maps, but also from it as traced on his own earlier maps, which are both more detailed and more exact. Whilst Junker nowhere makes this river cross the 4th parallel, Habenicht represents it as crossing three times. The former, again, puts every winding and every affluent of the Welle half a degree further to the west than they appear on Habenicht's map. The Werre is shown by Junker between 3° and 4°, and by Habenicht between 4° and 5° N. lat. We might perhaps at first sight be inclined to believe that Junker had consistently placed all his positions half a degree further towards the west, were it not that he represents the sources of the Werre as lying half a degree east of the situation assigned to them on Habenicht's map. Furthermore, the direction of the Werre on the two maps is not the same: Junker makes it south-west; Habenicht gives it as westerly, with the slightest possible inclination to the south-south-west. Finally, when we come to the Kuta-Mbomu, we find very serious divergences between Junker and the English and German cartographers. The intrepid traveller even calls in question the geographical determinations of Nachtigal and Lupton, which, although

made from different directions, yet corroborate one another with reference to the same region. The Kuta-Mbomu lies, according to Junker, between 4° and 5° N. lat., but according to Habenicht between 5° and 6°. From a letter written to the former authority we learn that Lupton's people covered the distance between Foro and the river Kuta-Mbomu in seven days, whence Junker estimates it at two and a half degrees of latitude ; Habenicht, on the other hand, sets down the same route at eight days' journey, or only two degrees of latitude.

Schweinfurth's criticism upon Junker's map is to the effect that all distances are calculated at 3 per cent. more than they are on Ravenstein's, and that several positions are shifted to the west. It is, however, remarkable that the divergences between the maps of Ravenstein and Junker are greater in the case of the better-known places, and not so great for those with which we are less familiar. For instance, the route from Mesra by Gyur to Gattas measures 95 miles on the map of the German traveller, but only 79 miles on that of the English geographer. From this we are led to infer that Junker's data with respect to facts which we have insufficient means of controlling likewise deviate to a considerable extent. Assuming that Junker's data are perfectly correct, he would have penetrated to a relatively great distance into the *terra incognita* of Central Africa ; nevertheless, in actual fact he went but a very little way west of the Itimbiri. We are therefore compelled to abstain from making use of Junker's results for the present. It is to be hoped that in his longer work describing his journeys (which he is now reported to be writing) he will have paid more regard to the existing literature bearing upon his subject, and to the cartography of the same. At all events, it is indubitable that the confluence of the Welle, Werre, and Kuta-Mbomu was never beheld by him.

As we have seen, none of the eight hypotheses mentioned is inexpugnable. We have, however, not yet mentioned the common basis upon which they all alike proceed, namely, that the Welle, Werre, and Kuta-Mbomu unite to form one and the same stream. Still we must not forget that this is only an hypothesis. In venturing to put forward a ninth view of the Welle problem, we offer it in complete independence of the hypothesis just alluded to. The solution of that problem involves not only the determination of the outlet of the Welle, but also of the sources whence the northern tributaries of the Congo between Stanley Falls and Equatorville get their great mass of water. For when we take this latter factor into consideration, we see that if all the streams of the Welle system pour their united volumes into the Congo, the remaining large affluents of this river will be deprived of their supplies. If, however, they do not all unite for this purpose, we obtain a result of an entirely different character.

We start with the hypothesis that the Welle, Werre, and Kuta-Mbomu do not unite their waters, for no confluence has ever yet been seen by a European. All that we know about the Welle is that it has first a westerly

and then a south-westerly direction. This however rests upon the information of natives, and is entitled to just about the same amount of credit as the statement made to Stanley by the natives of Nyangwe that the Congo flowed only northwards. From Junker's investigations we learn that the Welle proceeds towards the south-west; and the same remark holds good with respect to the Werre and the Kuta-Mbomu. Potagos, who did not see the Welle itself, but some other river which he took to be the Welle, has no information pertinent to the case in hand. And Lupton only speaks on the authority of native reports. From all this it results that of the confluence of the three rivers we possess no certain knowledge.

Thus there are between the Nile, the Shari, and the Congo four rivers whose direction, course, and embouchure are all unknown to us, viz., those of the Nepoko, Welle, Werre, and Kuta-Mbomu. We have also in the same region three rivers joining the Congo, about which we know nothing beyond their mouths. Besides these facts we have the large volume of the Shari still unaccounted for. Our theory then is this: we divide the four rivers first mentioned into two groups, the first embracing the Welle, Werre, and the Nepoko, which join the Congo, whilst in the second we place the Kuta-Mbomu, which we consider to belong to the Shari basin.

The grounds upon which we rest our theory are as follows:—

(1) The Aruwimi is the continuation of the Nepoko, as we learn from Stanley's latest reports: and since we are not acquainted with any important tributary of the Congo in the regions lying to the south of the Nepoko, this last river must receive several streams from that quarter.

(2) According to the data available for comparison, the volume of the Itimbiri agrees best with that of the Welle. The former river, below the Lubi Falls, varies from 750 to 870 yards in width, which corresponds to the volume of the Welle without the Werre and the Kuta-Mbomu. The Itimbiri also continues the direction of the Welle. It is not impossible that the Welle may pass through Lake Kei-el-Abi, and that this lake is, further, merely an expansion of the river. Besides, the distance between the nearest known points on the Itimbiri and the Welle is considerably shorter than that between the corresponding positions on the Werre or the Kuta-Mbomu and the Itimbiri. For these reasons we consider the Welle to be the upper part of the Itimbiri.

(3) Passing over the Werre in the meantime, we come to the Kuta-Mbomu. The term "Kuta" of the Mbomu is known to us from Lupton Bey's accounts. Now, Nachtigal's estimable servant reported a river of this name as being an affluent of the Shari. The basin of the Kuta-Mbomu is more extensive than that of any of the other three rivers; and the large volume of the Shari at its embouchure can only be accounted for on the supposition that it drains some basin of similar extent to this. Nor does the oscillation or rise and fall of the water at all invalidate this view, since that phenomenon has only been observed in the case of the Welle. The Kuta-Mbomu likewise lies much nearer to Nachtigal's Bahr-el-Kuta than the Aruwimi, Itimbiri, or Ubangi. We therefore regard it as pro-

bable that the Kuta-Mbomu belongs to the hydrographical system of the Shari.

(4) Turning now to the Werre, this river, in accordance with the conclusions we have come to above, can only belong to the Ubangi, and, as far as the direction goes, it may be looked upon as the upper course of the latter stream. It is true that the highest point yet reached up the Ubangi lies geographically nearer to the Kuta than to the Werre ; yet that, we think, does not outweigh the reasons adduced above for counting the Kuta to the system of the Shari. On the other hand, there exists sufficient agreement between the volumes of the Werre and the Ubangi, as well as between the rise and fall of their flood-waters, to justify their identification.

The real solution of the Welle problem, however, to which we have ventured to add a new hypothesis, is one that can only be achieved at the expense of much money, and possibly human life. The expedition on which Stanley is at present engaged, although it has thrown some light on this hydrographical puzzle of the *terra incognita* of Central Africa, will hardly set all our speculations on the subject at rest, for the bold explorer is only skirting the confines of the unknown region, not crossing right through its midst.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

THE Anniversary Meeting of the Aberdeen Branch of the Society was held in the Albert Hall on the 8th November last—Mr. David Stewart, Convener of the Local Committee, presiding, The Earl of Aberdeen, Vice-President of the Society, delivered an address on "A Tour Round the World," and, on its conclusion, was awarded a most hearty vote of thanks on the motion of Lord Provost Henderson, seconded by Mr. Ferguson of Kinmundy.

The Dundee Branch of the Society held its Anniversary Meeting on the evening of the 30th November last—Mr. A. J. Buist, presiding. Sir Charles Bernard, K.C.S.I., late Chief Commissioner of Burma, delivered an address on "Burma ; the new British Province," which was illustrated by a series of lantern views. On the motion of Mr. Weinberg, seconded by Captain Clayhills Henderson, a vote of thanks was awarded to the lecturer.

An Ordinary Meeting of the Society was held in the Freemasons' Hall, Edinburgh, on Wednesday, 21st December last. Mr. Ralph Richardson, Honorary Secretary, presided. A paper by Sir Francis de Winton on "Explorations in Central Africa," was, in the unavoidable absence of the author, communicated to the meeting by Dr. George Smith, C.I.E. Dr. Robert W. Felkin, in response to an invitation from the chair, addressed the meeting at some length. A series of views illustrating the subject of the paper was subsequently exhibited by the lime-light lantern.

The Geographical Club held its first meeting on Saturday evening, 10th December last, when a discussion on the future of Tropical Africa was introduced in a paper by Mr. Joseph Thomson. The Club, it may be mentioned, has been established in connection with the Society, for the purpose of discussing geographical subjects, and is open to all members of the Society.

GEOGRAPHICAL NOTES.

ASIA.

Transcaspian Railway.—Letters have been received from Teheran stating, on excellent authority, that the railway bridge across the Oxus at Charjui is making rapid progress, and that railway communication from the Caspian at Krasnovodsk, *viâ* Merv and Charjui, will be opened as far as Bokhara in April, and as far as Samarkand in June next. Colonel Augustus Le Messurier, C.I.E., Royal Engineers, recently went over the Transcaspian railway from Krasnodsk to the point to which it is now open beyond Merv, and thence by post to Bokhara, performing the whole journey from the Caspian to Bokhara and back in twelve days.

Russian Railway across Siberia.—The long-projected railway across Siberia appears now to have been definitely decided upon, and General Annenkow is mentioned as the director of the great work. It is not intended, we are told, to build a continuous line of railway, but to take advantage of the water communications available, and connect these by railroads. The railway is intended for strategic purposes, and cannot fail to influence the relationship between Russia and China.

Railway in China.—The construction of a railway between Peking and Shanghai is now definitely arranged for, and the concession is reported to have been ratified by the Chinese authorities.

The French in Indo-China.—The administration of the French colony of Cochin-China and protectorates of Tonkin, Annam, and Cambodia, has, by a decree of the Republic, dated 17th November 1887, been placed under a "Civil Governor-General of Indo-China."

AFRICA.

The British Protectorate in West Africa.—It is officially announced that, in conformity with treaties concluded within the last few months, the coastal regions between the British Protectorate of Lagos and the right bank of the Rio del Rey at its mouth, also the territory in the basin of the Niger belonging to the Royal Niger Company, have been placed under British protection.

Dr. Krause's Journey.—Lieutenant Kund, writing from Accra (Gold Coast), 26th Sept. 1887, to the Berlin Geographical Society, gives some details of the journey made by Dr. G. A. Krause, whom he met at Accra. Krause's intinerary was as follows :—"From Accra into the interior in May 1886—Akropong—across the Volta at Kpong—eastwards from the Volta to Kpando, Krahje, and Sálaga —from Sálaga NNW. to Dagómba, Walawála, through the eastern Gurunsi and Busánga to Wagaduga and Ban Jágara. The return journey was made by the western Gurunzi and the Ashanti territory to Kintimfo ; eastward to Sálaga, and, after crossing a high mountain, to Sogede ; from thence southward to Beletá, Gbeshi, and Atakpáme to Pla (Great Popo). Speaking of the appearance of the country he traversed, Dr. Krause stated that northwards of Sálaga it comes more and more under the influence of the Sahara, becoming more desolate at every step. Tobacco and rice he found everywhere, the latter sometimes wild ; kola nuts and salt were the chief articles of commerce. The ruling race in the north of the territory visited by him are the Fula ; more towards the coast the difference in the races and languages is considerable, though the Haussa, who hold the commerce to Timbuktu almost exclusively in their hands, give the predominating language. The merchants and the "aristocracy" of the tribes are Mohammedan, the remainder as yet heathen ; the country was found to be thinly populated.

The New Expedition to the Congo.—The formal announcement in *Le Mouvement Géographique* of 23d October last that Captain Van de Velde had left for Stanley Falls, to take charge of an armed force comprised of some 50 Haussa and Bangala soldiers for the purpose of restoring order and upholding the authority of the Congo Free State, is supplemented by an apparently "inspired" notice in the excellent geographical publication *Deutsche Rundschau für Geographie und Statistik*, from which we glean the following particulars:—The expedition has for its object, apart from the expulsion of the Arab slave-dealers, the extension of the authority of the State to the confines of Uganda. With this object in view, Captain Van de Velde proposes to follow the upper course of the Congo to the south, to re-establish the stations on the river, and to reach Lake Tanganika from Nyangwé. The stations founded by Captain Storms in 1885, but since abandoned, on the western shores of Tanganika, will doubtless be re-established, for the State, it is reported, contemplates no less a task than exercising its authority over the whole of the region placed under its jurisdiction at the Berlin Conference of 1885, including M'bode, Bakumu, Uregga, Manyema, and Kasongo, and from the Albert Nyanza in the north to Lake Bangweolo in the south. The Sultan of Zanzibar will be called upon to recognise the provisions of the General Act of the Berlin Conference, and to put a stop to Congo Negroes being sold within his territory, for it is the intention of the State to create a great trade route from the Congo to Zanzibar.

Lieutenant Wissmann's Journey.—The first detailed report of Lieutenant Wissmann's second journey across Africa appears in the current *Verhandlungen* (No. 9, Band xiv.) of the Berlin Geographical Society. References were made to the progress of the expedition on pages 255 and 485 in the last volume of the Magazine; we are now able to supplement them by briefly mentioning the route taken by Lieutenant Wissmann, and the result of his expedition. Starting from Luluaburg in October, 1886, with a caravan of 89 persons, which was subsequently increased to 1000 by the numerous followers of the son of Kalamba and of the Empress of the Muata Yamvo Empire, who joined the expedition, Lieutenant Wissmann struck NE. to the Lubi, at the mouth of which he crossed the Sankuru. Unable to prosecute his intended journey to the NE. (which might have yielded important geographical results) he gave up his plan of exploring the watershed between the Sankuru and the Congo. He turned to the south, without having crossed the Lomami, and struck his route of 1881 in the territory of the Beneki —which he found depopulated and devastated by war, the slave-trade, and small-pox—and following his former itinerary, with some slight divergencies, he reached Nyangwe, and subsequently Tanganika by the ordinary route, coming out at Kilimane on the coast, by Lake Nyassa, the Shiré, Zambesi, and Kwakwa. Lieutenant Wissman confirms a decided progress by the natives, formerly visited for the first time by him, in their methods of cultivating the soil.

Exploration of the Kuango.—Dr. Mense, who at the end of 1886 accompanied the Rev. G. Grenfell in his exploration of the Kuango to the Kingunji rapids, gives a preliminary account of the journey (so as not to forestall that of Mr. Grenfell) in the *Verhandlungen* (No. 8, Band xiv.) of the Berlin Geographical Society.

The *Peace*, with Messrs. Grenfell and Mense on board, reached the delta formed by the Kuango at its confluence with the Kassaï, on the 16th December 1886. The direction of its course before its confluence is NE., that of the Kassaï being NW., the two rivers forming together an angle of 110 degrees. The three branches of the delta enclose a large number of islands, very difficult to distinguish. Following the western arm, the travellers reached a village on the left bank, the inhabitants of which (the Bavili) invited them to land.

Their queen, Mai-Munéné, stated that she had heard of the white man, but had not seen one until then; she treated the travellers with distinction, and gave them information as to the upper course of the river. Continuing her voyage on the following day, the *Peace* advanced with caution, and they were shortly able to confirm the intelligence given by the queen Mai-Munéné, of the union of the black waters of a tributary with the yellow waters of the Kuango. The Kuango was found to receive on its right bank a great affluent, 438 yards wide at its mouth, coming from the south-east. At first the travellers thought to identify this affluent with the Saia or the Kuilu, traversed by Lieutenants Kund and Tappenbeck, but a native stated that at its mouth it bore the name of Juma. Between the Kuango and Juma extends a grassy plain, apparently exposed to frequent inundations. Higher up, the banks become more and more wooded. There were no inhabitants, but numerous traces of elephants and buffaloes. They passed through veritable forests, and, continuing the journey, found themselves in a region of remarkable vegetation. Higher up still, the river was larger, and they found great difficulty in obtaining provisions; they passed no villages and only occasionally natives, who fled with cries of fear on the approach of the steamer. They thus had to live on what fell to their guns. On the 20th December they came among a native population, and were everywhere received with shouts of defiance and the shaking of spears. Finally assured of the pacific intentions of the *Peace*, the natives were induced to come on board. The *dénoûment* is amusing. Seeing the party unarmed, the natives refused to let the steamer pass, and promised a visit on the following day. They came in their numbers, shouting their war-cry; but the *Peace* blew her whistle with such effect that her enemies were scattered without a blow being struck. On 23d December the *Peace*, advancing with great caution, obtained provisions from the Wampfuno natives, who stated that they knew the village at Stanley Pool, Kimpoko, and gave the name of Kwa to the Kuango, a name that is borne by the Kassaï in its lower course. On 24th December they were in latitude 4° 26′, and the navigation of the river continued to become more and more difficult. Here the natives, who were familiar with white men, evinced a lively desire to barter; they had with them the boat abandoned by Von Mechow. They reached the rapids of Kingunji on the 27th, and were able to confirm the accuracy of Von Mechow's map of the district. The return voyage to Stanley Pool was made in seven days.

Dr. Meyer's Ascent of Kilima-njaro.—Dr. Meyer publishes, in the current number (33 Band, 1887) of *Petermann's Mitteilungen*, a provisional report of his ascent of Mount Kilima-njaro, from which we have abstracted the following:—

Dr. Meyer arrived at Taveita from Mombassa on 28th June. Two days' march took him to Mareales' village, where he was well received by the Marungu Sultan. With three guides and twenty-two men, he started a few days later for Kibo. At an elevation of 5900 ft. he passed the last banana plantation, and entered the forest land, which is almost always surrounded by mist, leaving it again on the following day to enter on the grassy slopes beyond. His route, which at first was northerly, was now changed to north-west, and he continued to follow, more or less, the upper fringe of the primeval forest. At the end of the second day he reached the spot (at about 9840 ft.) where Johnston had camped for some time in the year 1884. Here for the first time Dr. Meyer saw Kibo and Kimawenzi clearly. He obtained eight volunteers from his caravan, who offered to accompany him in his further ascent, for the native custom is to leave the European explorers at this point. On the third day of his march Dr. Meyer started north, direct for the middle of the

saddle of land that connects the peaks of Kibo and Kimawenzi. Passing grass-covered lava fields, in which rushing streams of snow-water—mostly 150 feet deep—had cut their way, he followed the course of a lava stream and reached an escarpment of the saddle—at about 13,100 ft. He encamped for the night at a favourable spot close by. On the following day the eight volunteers hesitated to proceed ; only his companion Herr von Eberstein, his two personal servants, and an Asikari were therefore left to him. Carrying a small tent, woollen coverings, a photographic apparatus, and provisions for three days, the small party again struck north up the mountain, following, as before, a lava field in the direction of the saddle. A short distance further brought them to the foot of a precipitous hill, that gave rise to the lava stream on which they were standing, and showed that they were nearer Kimawenzi than to Kibo ; between which two summits they observed five more hills. The route was changed to north-west, and a march of eight hours' duration brought the party to the small cone of ashes bordering on Kibo, where they fixed their last encampment, the Negroes, on account of the great cold, returning to their previous resting-place. The two European travellers were then left alone to pass the night. With the thermometer at 11° C., sleep was not found possible for them, and they rose at break of day to ascend the peak of Kibo. A glittering wall of light-blue ice which protected the upper rim of the crater, and reached down for some distance on the south side, appeared to offer the chief obstacle to a successful ascent. An attempt was therefore made on the east side of the mountain across the steep snow-fields that connected the walls of lava. For the first three hours all went well. The weather was clear and the snow hard, but the two travellers soon got into mist, which continued to increase in volume until the sun was hidden and the thermometer fell from +8° C. to −3° C., the falling sleet obliterating their foot-steps. Dr. Meyer's companion shortly after gave way from exhaustion, and was left behind. Alone, Dr. Meyer continued to climb the steep ascent, but he was stopped by the ice-wall already alluded to, which he could not climb unaided. The exact altitude reached Dr. Meyer does not state, but elsewhere we learn that it was 19,680 ft. A contoured sketch of the two summits is given with Dr. Meyer's provisional report.

AMERICA.

Greenland.—Herr Hansen, the conservator of the Museum in Bergen, proposes to cross Greenland on snow-shoes ; starting from Cape Dan on the east coast, he hopes to reach Disko Bay by crossing the inland icy plateaux (5120 feet above sea-level). Herr Hansen will be accompanied by a Norwegian and two Lapps. For the transport of the necessary provisions, etc., they intend to use light sledges.—*Das Echo*, December 8, 1887.

The Head-waters of the River Ottawa.—Dr. Bell, of the Canadian Geological Survey, has returned from an extensive exploration of the little-known country around the head-waters of the Ottawa River. Although the Ottawa has sometimes been supposed to take its rise from Lake Temiscaming, or from Grand Lake, Dr. Bell now states that its source is some 300 miles due north of Ottawa ; that it first runs westward to Lake Temiscaming, and on leaving this lake it doubles on its former course and flows east for some 400 miles to its junction with the St. Lawrence at Montreal Island. Lake Temiscaming, which lies north and south in a great depression, is, according to Dr. Bell, a sort of collecting basin from the east, west, and north, for the waters of the Ottawa. Interviewed by a reporter of the *Ottawa Daily Free Press*, Dr. Bell gave the

following particulars :—"In approaching its source, and when the Ottawa has become a mere brook, it divides into two branches of about equal size. The more southern of these has its origin in a lake which the Indians call Ka-pimmitchigama, or Cross Lake, because it lies across the general course of the brook, and, being the largest lake in the vicinity, it has sometimes been considered as the head of the Ottawa River. I followed the more northern branch, which has a longer course, and found that it flows out of a lake 2 or 3 miles long, which is the real source of the Ottawa, being at the head of the longest branch, and, as it had no name, I proposed to call it Ottawa Lake, because as a general rule, in all our vast northern territory, the lakes at the sources of the rivers bear the same name as the rivers themselves. It is surrounded by low ground, but hills are to be seen at no great distance in different directions. At the head of this lake we found an old Indian portage trail, which conducted us across the watershed, a level neck of land only half a mile wide, to a larger lake on the same level (according to my barometer), which sends its waters into the Gatineau River. The outlet of this lake proved to be very small, but after following it for a few miles it was joined by another brook, and by and by the enlarged stream was increased by a third and then by a fourth. Still, owing to the low water and the rapid descent of the upper section of the Gatineau, it cannot be said to be navigable even by canoes at this season of the year."

The Nicaragua Ship-Canal.—*M.* de Lesseps is not to enjoy the sole honour of piercing the isthmus which divides the Caribbean Sea from the Pacific Ocean, for in April last (according to Dr. Franz Boas in *Science*) a contract between the Nicaragua Canal Association and the Republic of Nicaragua was signed, and the work was to have been commenced last October. The Panama route proposed by M. de Lesseps has so largely monopolised public attention, that the route *vid* Lake Nicaragua has, especially since the death of Admiral Bedford Pim, attracted comparatively little notice. It was surveyed by Mr. Childs so long ago as 1850-54, and by the United States Surveying Expeditions in 1872-73, and 1885. The expedition of 1885 was under Mr. A. G. Menocal, who was also chief civil-engineer of the expedition of 1872-73, and is the projector of the route now proposed to be followed under the contract entered into in April last. (See Vol. iii. p. 260.)

Lake Nicaragua, which occupies the central part of the isthmus, will form the summit-level of the proposed ship-canal. Its outlet is the river San Juan, which falls into the Caribbean Sea. Near the lake the river is broad, and flows through an open country, with an average depth of 19 feet. Twenty-eight miles, however, below Lake Nicaragua, rapids occur to obstruct navigation. Further down, the River San Carlos enters the San Juan and destroys the navigation, owing to the detritus it deposits, and the freshets to which it is subject.

Again, the harbour of Greytown (or San Juan del Norte), the entrance to the Canal on the Caribbean Sea, has been silted up by the River San Juan, which here discharges its waters. The main labours, therefore, to be performed by any projector of a ship-canal by the Nicaragua route are, *first*, to deepen the harbour of Greytown, and *second*, to obviate the obstructions caused by the River San Carlos and the rapids already referred to. Mr. Menocal's project is believed to be a solution of these problems, and has consequently been accepted by the Nicaragua Canal Association.

Previous to describing how Mr. Menocal proposes to overcome these difficulties, we may refer, briefly, to discarded routes. The Emperor Napoleon III. always took an interest in the piercing of this isthmus. He

advocated the formation of a canal running from Lake Nicaragua through the River Tipitapa to Lake Managua, and continued to the port of Realejo. This route, as well as those to Salinas Bay and San Juan del Sur were found impracticable, and Brito at the mouth of the River Grande was chosen as the Pacific terminus. Whilst Commander Lull selected the River del Medio route from Lake Nicaragua to the Pacific, Mr. Menocal favours that by the River Lajas.

In 1872 a canal was projected from Greytown to near the mouth of the River San Carlos by crossing the delta formed by the mouths of the River San Juan, but Mr. Menocal has discarded this route and adopted one proceeding almost in a direct line from Greytown to the San Carlos. Let us follow his route from Greytown on the Caribbean Sea to Brito on the Pacific Ocean.

As already stated, the first difficulty is with the harbour of Greytown, which is silted up by the San Juan falling into it. Mr. Menocal hopes to surmount this difficulty by building a jetty into the sea, cutting off the San Juan from the harbour, which he would thereafter deepen by dredging. From Greytoun, on the Caribbean Sea, to Brito, on the Pacific, is a distance of about 170 miles, of which only 40 will be traversed by excavated canals, and 130 will be open navigation along rivers and across Lake Nicaragua. The estimated time of transit from the Caribbean Sea to the Pacific Ocean by this route is only thirty hours. Thirty-two vessels per day or 11,680 in a year will be able to pass through the canal.

Leaving Greytown, the Caribbean terminus, a canal with three locks will take ships to the San Francisco Creek, which enters the River San Juan a little below the mouth of the River San Carlos. This canal will be some 23 miles in length, and 80 to 120 feet wide at the bottom, whilst its surface width will vary from 80 to 342 feet. An embankment of 6,500 feet long will be built across the mouth of the San Francisco Creek, converting it into an artificial lake 30 to 50 feet in depth ; whilst a dam 1255 feet long will be constructed at Ochoa on the River San Juan, just below the confluence of the River San Carlos. By these means, it is believed, the rapids will be overcome by deepening the water of the River San Juan all the way back to Lake Nicaragua, the surface of which will thus be maintained at a level of 110 feet. The River San Juan down to the San Francisco Creek will be converted into an extension of Lake Nicaragua. Once arrived, therefore, at the San Francisco end of the canal from Greytown, the voyager will sail uninterruptedly up the River San Juan and across Lake Nicaragua to the canal near the River Lajas, which will bear him to the Pacific Ocean at Brito. This latter canal will have four locks of a length of about 17 miles. The total number of canal locks required on this Nicaragua route will be seven, viz., three on the Caribbean and four on the Pacific side of the isthmus.

It is estimated that the canal and its accessories can be completed in six years, and its cost, including twenty-five per cent. for contingencies, is put down at upwards of £12,800,000. The characteristic features of Mr. Menocal's scheme, as compared with any previous one, is the extension of the level of Lake Nicaragua down the River San Juan by means of the high dam at Ochoa, and the embankment near the confluence of the San Francisco. Again, on the River Lajas route for the canal to Brito, a rapid and troublesome mountain stream has to be passed. This difficulty will be overcome by Mr. Menocal by diverting it into a tributary of the River Lajas.

Besides the land necessary for the construction of the canal, considerable land-grants are ceded to the Canal Association, ranging from alternate lots of 2 miles frontage and 2 miles in depth, to 3 miles frontage and 6 miles in depth,

whilst all along Lake Nicaragua to the mouth of the River Lajas lots of 1 mile square will be given.

Operations in connection with the construction of the canal were, as before stated, expected to commence last October. The climate of Nicaragua is an important consideration, particularly while the canal is being constructed. The western or Pacific port of Nicaragua is undoubtedly healthy, whilst the eastern part, the swampy delta of the River San Juan, is subject to malaria. As already shown, Mr. Menocal avoids the delta considerably by taking his canal direct from Greytown to the San Francisco Creek.

The geology of the district to be traversed by the canal is not very well known. It would appear, from specimens obtained, that metamorphic rocks form the foundation of the eastern part of the country. Overlying these, volcanic lavas, such as very compact basalts, andesites, and rhyolites, are found. The precise route to be followed by the canal will not be finally adopted until the results of certain surveys and borings, which are to be carefully made, are laid before eminent engineers in North America and Europe. It is not stated by Dr. Boas, in *Science*, whether earthquakes may be expected to interfere with the canal either during construction or after completion.

With regard to the traffic which may be expected to pass along the canal, it has been estimated by the United States Bureau of Statistics that, in 1885, more than 4000 vessels of upwards of 4,000,000 tons could have used a canal through Central America if one had been available, whilst the Statistical Bureau of Hamburg estimates only half that number and tonnage of vessels for 1883. In the figures of the latter Bureau, however, the traffic between the Pacific and Atlantic parts of North America is not included, but there can be little doubt that this trade will rapidly develop after the opening of the canal, and that it will form one of the most important items of income of the Canal Association. Besides, to this must be added the trade between the interior of the United States and Eastern Asia, the greater part of which follows, at present, the route of San Francisco, as well as part of the transcontinental trade. The truth is that such a canal as this would effect a complete revolution in trade, and it is difficult, if not impossible, to say either how much traffic would pass through it, or what country would benefit most by it. It is satisfactory, however, to think that with M. de Lesseps working at Panama and Mr. Menocal at Nicaragua, the long-closed Isthmus of Central America will probably soon be pierced.

AUSTRALASIA.

Proposal to Retain Native Names of New Discoveries.—At the October meeting of the Royal Geographical Society of Australasia, Queensland Branch, the Hon. Secretary moved the following resolution, of which he had given notice at a previous meeting:—"That the Queensland Branch of the Royal Geographical Society of Australasia views with disfavour the tendency exhibited by some recent explorers in New Guinea, in naming their discoveries, to disregard the native names of the most prominent physical features of the country; that it is expedient to discourage this growing tendency, and also, in so far as practicable, to preserve the native place-names; and that all Geographical Societies be invited to co-operate by an expression of opinion." Mr. Thomson stated that at the Intercolonial Conference held recently in Adelaide a similar motion was brought forward. The motion was seconded by Mr. C. Burdorff, and carried; and it was further resolved that the resolution should be forwarded by the Hon. Secretary to all the Geographical Societies with which this Society was in communication.

We have much pleasure in giving additional publicity to this sensible resolution, in which we heartily concur. It is perhaps not generally known that the

question has already been taken up by the Surveying Department of the Admiralty, orders having, we understand, been given to restore as far as possible on the charts, the native names of islands, rivers, etc., in the Western Pacific, especially in and around the British parts of New Guinea. It is, perhaps, not too late to hope that the Germans may adopt similar measures with respect to their new possessions, though they have in the meantime replaced the names New Britain, New Ireland, etc., by equally unmeaning designations, those islands having—a somewhat uncommon circumstance in savage islands of so large an extent—native names of their own. Several of the names given by Cook—as *e.g.* in the cases of the great Australasian colonies, New Zealand, New South Wales, etc.—must now be considered unfortunate, though we are far from recommending that they should be changed. It is, of course, always satisfactory to retain some memorial of original discoverers. We should be sorry, for instance, to see the name of Dampier eliminated from the German territories above mentioned ; and some of the minor names given by him, as King William Island, and Rooke Island, mark besides the date of the discoveries, and have by this time some claim to respect from their antiquity.

Mr. Cuthbertson's Journey in New Guinea.—Our correspondent at Brisbane, Mr. J. P. Thomson, sends us some interesting particulars relating to Mr. W. R. Cuthbertson's recent ascent of Mount Obree in New Guinea. The explorers found the country very difficult to traverse, being often up to their waists in water while following up the bed of the Margaret Creek, which leads to the base of the mountain, the current running in rapids at from 10 to 11 knots an hour. The bed shows traces of metalliferous deposits, which it was hoped might, if examined, furnish payable results. As was mentioned in our last Number, Mr. Cuthbertson reports the height of Mount Obree to be only a little over 8000 feet—*i.e.* 2000 feet below the Admiralty measurement. We have much hesitation in accepting this correction, the calculation of height of this and the neighbouring peaks having been made with especial care. The view from the summit was very disappointing, little being visible except the tops of the clouds, which, excepting at early morning, seem never to disperse. The mountain near its summit is razor-backed, the breadth of the ridge being about 6 feet, with perpendicular cliffs on each side. At from 6000 to 8000 feet, very fine pines, rhododendrons, and other plants were found. The party were only able to remain one night on the top of the mountain, owing to the superstitions of the native guides and carriers, who believe it to be inhabited by the spirits of their departed relations, and the summit to be the especial domicile of the devil. Accordingly, although they accompanied the explorers cheerfully to within 1000 feet of the top, their terror then overcame them. Trembling, and their features convulsed with fear, they not only refused to proceed, but, picking up the entire camp equipage which the explorers had provided with a view to camping on the summit, they fled at full speed to the foot of the mountain, and nothing would induce them even to remain in its vicinity. The absence of birds and game of all sorts on the high lands was very remarkable ; the party seldom saw or even heard so much as a cockatoo. Mr. Cuthbertson's relations with the natives were excellent, and he contrived, by great tact, to take with him representatives from every village he passed from the coast onwards—the number of his followers at last exceeding 200. This had the valuable and important result of bringing into friendly contact the leading men of tribes which had hitherto been hostile. Mr. Cuthbertson has prepared a large map which, accompanied by a valuable detailed report, he will present as the results of his labours to the Victorian Branch of the Royal Geographical Society of Australasia.

NEW BOOKS.

The Tshi-Speaking Peoples of the Gold Coast of West Africa: Their Religion, Manners, Customs, Laws, Language, etc. By A. B. Ellis, Major 1st West India Regiment, Author of "West African Sketches," etc. Chapman and Hall, London: 1887. *Price* 10*s.* 6*d.*

In this volume Major Ellis, an experienced observer and recorder of the traits of West African character and customs, has made a contribution to the philology, ethnology, and folklore of the races inhabiting the Gold Coast, which is more scientific in form and more substantial in substance than any of his previous works upon the same subject. It describes, with the authority of a competent and keen-eyed witness and resident of twelve or thirteen years' standing, the religious beliefs and observances, the social laws and customs, and the affinities in language, music, and traditions of the peoples speaking the various dialects of the Tshi, or Tchwi, tongue—that is to say, of the inhabitants of the country between Accra and the mouth of the Assisi River, and extending backwards into the interior, as far, it is believed, as the Haussa tribes south of the Niger. The Tshi-speaking natives thus comprehend nearly the whole of the inhabitants of the Gold Coast, and also the Ashantis, and are interesting to us not merely on account of the singular study of Negro character, habits, and beliefs which they present, but also as being the subjects, or the troublesome and dangerous neighbours, of the British Crown. A great part of Major Ellis's book is occupied with clearing up doubtful points and rectifying mistakes into which his predecessors have fallen. It is not at all likely that we have yet heard the last word on these subjects, or that the author's own statements will be allowed to pass unchallenged. It is sufficient to say here, however, that he throws a flood of new light upon the conceptions and practices of the Negro races of the Gold Coast and Ashanti—especially upon their religious ideas and worship. Major Ellis explains that the Tshi-speaking tribes divide their deities into four groups—those who receive general worship, the gods of particular towns and districts, and tutelary deities of families and of individuals. The first are few in number, and are believed to be too indifferent to interfere often in human affairs, but they are supposed to appoint the second class; the second class (almost all malignant beings) appoint the third; while the fourth may be acquired in a great variety of ways through the agency of the priesthood—a most powerful element in Tshi life and society It is a curious fact that the most powerful of the three great "General Deities" of these countries—Nana-Nyankupon, the "Lord of the Sky"—is none other than a distorted and imperfect reflection of the Christian God, and that the traces of a higher religious development, in the conception by these peoples of a *quasi*-omnipotent Being unapproachable by sacrifice, which have surprised some of the missionaries, have only been copied from their European neighbours in the course of four centuries. Major Ellis insists, contrary to generally received beliefs, that the religions of this part of the West Coast are only slightly tinctured with "fetishism," in the proper sense of that term; and he asserts, somewhat paradoxically, as appears at first sight, that "fetishism"—meaning the ascription of supernatural or magical powers and properties to tangible and inanimate objects—"is only arrived at after considerable progress has been made in religious ideas, when the older form of religion becomes secondary, and that it owes its existence to the confusion of the tangible with the intangible, of the material with the immaterial—to the belief in the indwelling God being gradually lost

sight of, until the power originally believed to belong to the god is finally attributed to the tangible and inanimate object itself." Among the Tshi-speaking peoples, he says, religious ideas have in comparatively few cases proceeded beyond the idea of the "indwelling spirit," whose temporary residence in, and, as it were, accidental association with, the so-called "fetish stone," or "fetish tree," is fully recognised by the natives—they have not yet "advanced" as far as fetishism.

South African Sketches. By A. B. Ellis, etc. Chapman and Hall, London: 1887. *Price* 5*s.*

These are pleasantly-written sketches and anecdotes of life and adventures in the neighbourhood of the diamond fields. They cannot be said to have any geographical importance, beyond that of acclimatising their readers to the atmosphere and surroundings of Kimberley and the Cape frontier.

Egyptian Archæology. By G. Maspero, D.C.L. Translated from the French by Amelia B. Edwards. London: H. Grevel and Co., 1887. Pp. vii. and 328. *Price* 10*s.* 6*d.*

The ancient civilisation of Egypt is perhaps the most striking instance in history of the influence of physical environment in determining the special character of a nation's development. The inhabitants of the Nile Valley owed to their unique geographical position not only that immunity from invasion which left them free for thousands of years to develop their internal resources, but also those ideas concerning nature and the universe which in so marked a degree were reproduced in their Religion and Art. From this point of view, Egyptology has a distinctly geographical interest, and among later additions to the literature on the subject, we know of no handbook which may be so confidently recommended to every class of readers as Professor Maspero's recent work. The author's name is sufficient guarantee for scientific accuracy in detail and systematic treatment, but, in addition to this, we have much that is new, both in matter and interpretation. Hitherto, archæologists have devoted their attention almost exclusively to tombs and temples, but the chapter on "Civil and Military Architecture" opens up a new mine of information. M. Maspero gives a graphic description of the construction of dwelling-houses, fortresses, and public works, the latter including roads, bridges, quarries, and the irrigation system, which played so important a part in the fertilisation of the country. The Lake Mœris theory is discussed and dismissed as absolutely untenable—the statement of Herodotus being unsupported by any other form of evidence.

The other sections of the book—"Religious Architecture," "Tombs," "Painting and Sculpture," and "Industrial Arts"—are equally interesting and suggestive. The relation between cause and effect is everywhere pointed out, and an unusual amount of space is devoted to methods of construction and technical processes. The text is richly illustrated by drawings, many of them quite new to us, which have been admirably reproduced. Miss Edwards' translation is excellent, and her foot-notes add to the value of the book.

The Story of the Niger: A Record of Travel and Adventure, from the Days of Mungo Park to the Present Time. By Robert Richardson. London, Edinburgh, and New York: T. Nelson and Sons. 1887. 3*s.* 6*d.*

This is an account of the exploration of the River Niger—told essentially by "the actors in the drama" themselves. Intended as it ostensibly is for those who love "a tale of travel and adventure," it must not be con-

sidered too seriously from a Geographical point of view. A perusal of its pages, indeed, soon shows us that it is more adapted to stimulate the imagination than to add to our Geographical knowledge. What value it might have had in the latter respect is made useless by the absence of a good map of the Niger. Without such assistance, it is not possible to follow intelligently the footsteps of the various travellers. It is true that a rough map of the size of the page enables the reader to see where the Niger is in relation to the great continental zone called the Sudan; but we find in it such spellings as "Soodan" for S(o)udan, and "Howssa" for Haussa. The letterpress is equally characterised by orthographical vagaries, as, for instance, "Sackatoo" and "Sokoto," "Yarriba" and "Yoruba," "Filiani" for Fillani, etc. The author even misspells the most recent of the explorers whose travels he describes—*i.e.* Mr. Thomson, whose name is given as "Thom*p*son." As a specimen of the errors the compiler has permitted himself to fall into, we may quote the following:—"In 1882 the British Government granted the Company (The United African Company) a Royal Charter, and its name now became the 'National African Company.'" The charter was only obtained in 1886, and the Company, from being the "National African," became the "Royal Niger Company."

Ulysses, or Scenes and Studies in many Lands. By W. Gifford Palgrave, H.M. Minister Resident in Uruguay. Pp. 385. London: Macmillan and Co., 1887.

Mr. Palgrave must be well known to readers of twenty years standing as the author of one of the most remarkable books of travel of that day—his journey through Central Arabia. He has also published a volume of Essays on Eastern Questions. The first four Essays in the volume before us deal practically with the same theme as these—viz., the decaying condition of the Turkish Empire. The remaining chapters, however, go further a-field. Among them we find an interesting notice of the gallant little State of Paraguay, which, after a heroic resistance against the forces of half the South American Continent, was at last nearly exterminated. A very pleasant and characteristic paper treats of "Malay Life in the Philippines," where the charm and fulness of tropical scenery and life, among a happy and prosperous people, is, according to the author, seen to a degree not experienced elsewhere. If the reader of these Essays does not agree with all the views expressed, or with the deductions drawn occasionally, as it seems to us, from somewhat slender premises, he will nevertheless enjoy a series of vivid and picturesque sketches of scenery and life and manners, culled from the writer's experiences in various remote quarters of the globe.

Australasia: a Descriptive and Pictorial Account of the Australian and New Zealand Colonies, Tasmania and adjacent Lands. By W. Wilkins. London: Blackie and Son, 1888. Pp. 252. *Price* 2*s.* 6*d.*

This small volume is not a text-book of the geography of Australasia; it is intended by its author to serve as a reading-book for advanced classes. Viewed in this light it can be thoroughly recommended to young students in the mother country, and, in the hands of a competent teacher, it would serve as a supplementary text-book. Mr. Wilkins writes with a full knowledge of his subject, and presents his information to the reader in a concise and well-considered form. We agree with him, that it would be desirable to fix definitely the geographical limits of Australasia; his own attempt is scarcely satisfactory. The Royal Geographical Society of Australasia, at a conference held some three years ago, discussed this matter, but we regret that the printed report of the meeting gave

a definition that was full of blunders, and could not be followed. The map and illustrations in Mr. Wilkins's book are good.

Pictures from Holland. Drawn with Pen and Pencil. By Richard Lovett, M.A. London : The Religious Tract Society, 1887.

The present volume well sustains the standard of excellence to which this series of "Pen and Pencil" books can lay claim,—indeed, from an artistic point of view, which the subject naturally offers, it excels the majority. Mr. Lovett has given us a charming description of the "old-world" life in Holland, of its cities and artistic treasures, its scenery, people, and history. The illustrations, which are numerous and admirable, combine with the text in depicting and describing the country as it may be seen by the tourist who has a taste for art and archæology, and some interest in history.

Southern Germany and Austria, including Hungary and Transylvania. Handbook for Travellers. By Karl Baedeker ; with 14 Maps and 30 Plans. Sixth edition, Revised and Augmented. Leipsic : Karl Baedeker, London : Dulau and Co., 1887. *Price* 7*s.*, pp. xvi. + 441.

The high reputation of *Baedeker's South Germany* is now so thoroughly established, and its contents so well known to all tourists on the Continent, that we need only remark that the present edition is simply a reprint after thorough revision.

Great Britain, England, Wales, and Scotland as far as Loch Maree and the Cromarty Firth. Handbook for Travellers. By Karl Baedeker ; with 14 Maps, 24 Plans, and a Panorama. Leipsic : Karl Baedeker. London : Dulau & Co., 1887. Pp. lxii. + 530. *Price* 10*s.*

This latest addition to the well-known series of Baedeker's Handbooks is an excellent compilation, at once clear, concise, and practical. For travellers bent on investigating in detail the beauties and interests of our island it is apparently not intended, but is rather provided for that yearly increasing class of foreign visitors who require a compact guide to all that is best worth seeing. Still, there is a wonderful amount of detailed information compressed into six hundred pages. To have attempted more would have been to risk an unhandy volume, and we observe that in the preface Herr Baedeker recommends the *Thorough Guides* (Dulau & Co.) by Messrs. Baddeley and Ward, as supplying his own lack. Without such recommendation and acknowledgment, there is clear evidence of indebtedness to that series in many parts of the present volume.

Of defects, some are due to the fact that the book was printed in Germany ; for instance, it must be to the printer and not to the editor, that we are indebted for the information that Oban is situated "on a lonely bay, generally full of yachts and steamers," and the difficulties of securing accuracy in a mass of so many thousand facts may be pleaded against the appearance of the *Craigard*, burnt down a year ago, among the Oban hotels, and of Strathpeffer instead of Achterneed as the name of the station that two years ago was superseded by a terminal one on the new branch to our northern Spa. Speaking generally, there is less *limæ labor* observable in the Scottish part of the book than in the English. As to the cartography, the plans of the cathedrals and most of the towns are good and clear ; the sectional maps, however, are rendered indistinct by excessive and indiscriminate shading, and the railway maps have evidently been

prepared by some one unacquainted with the main routes of English travel. The panoramic sketch from Snowdon is excellent. After the manner of the immortal Mr. Weller senior, the general map and the Lakes section give us the choice between a "v" and a "w" in the case of Helvellyn and Helwellyn, but by an unfortunate slip the "railway" map of England puts Orrest Head instead of Windermere—an error likely to puzzle the intelligent foreigner.

Prefixed to the description of routes is a short introduction, in which, among other matter, a praiseworthy attempt is made to grapple with the difficulties of Welsh pronunciation—but surely *u*=*oo*, *e.g.*, Llandoodno is wide of the mark. "The Historical Sketch of Architecture in England," by Mr. E. A. Freeman, is admirably done, and is a paper of permanent value.

Royal Scottish Readers: History and Geography. London and Edinburgh: Nelson and Sons. 1887.

The great improvement in the schoolbooks of the present day is well shown in the *Royal Scottish Readers in History and Geography*. They are arranged for the six Standards of the Code as a complete course of geography, with the outlines of Scottish and British history up to the time of the Jubilee of 1887. The materials have been well chosen, and the plan has been carried out with literary ability and good taste. Each of the six books is profusely illustrated with portraits, pictures, and maps, all of which deserve praise for their excellence, while they have been judiciously chosen to illustrate the text and to fix the information in the memory.

There are lists of new words as they occur in the lessons, lists of accentuated historical and geographical names, notes of explanation throughout, and much besides that is likely to prove most helpful both to teacher and pupil.

Manual of the Sextant: containing instructions for its use in determining Time, Latitude, Longitude, and the Variation of the Compass. By Charles W. Thompson. London: John Bumpus, 1887. 8vo., pp. xiii. and 110. *Price* 6*s.*

Mr. Thompson has compiled a book that should be very useful both to travellers and to naval officers employed in hydrographic work on shore. He has given a very clear account of both how to use the sextant and how to avoid errors in its use; and we think that any one, with this book as a guide, may, after a few practical lessons, become an expert observer. The description of the sextant and its method of use is very clearly given, and the working out of latitude and longitude in various ways, with complete examples, leave nothing to be desired. The definitions, too, are very clear and concise, and the notes on the identification of stars will be useful even to those who stay at home. This book supplies a distinct want, and we can thoroughly recommend it to all those who wish for a reliable handbook on the subject. It is of a convenient size, and well arranged, and it certainly should form a part of the outfit of every traveller.

NEW ATLASES AND MAPS.

Atlas de Géographie Générale, avec Notes Statistiques, Historiques et Géographiques, par le Lieut.-Colonel Niox, Professeur à l'École de Guerre. Première Livraison: cartes—Indo-Chine (21), Sénégal et Niger (24), Péninsule des Balkans (15). 1887.

Paris: Librairie Charles Delagrave. Price 5 *fr.*

This is the first part of a large new atlas, which is to be issued in about ten

monthly parts, each containing three maps. The idea is evidently to produce a good popular atlas treating the geography of the world from a French standpoint—that is, giving special prominence to France and her colonies. The maps, of which sixteen are single, and fourteen double-page size, are very clearly and correctly drawn, but the engraving and printing are poorly executed. Each map is accompanied by four pages of text, giving a summary of the geographical information regarding the various countries. Of course, this atlas is not to be compared with such a magnificent work in cartography as the *Atlas Universel* of M. Vivien de Saint-Martin; but perhaps it is more desirable to have a less ambitious scheme, able to be carried out within a reasonable time, than a work of such magnitude as that of M. de Saint-Martin, commanding so much scientific and artistic detail, that few living geographers can hope to see it completed.

BERGHAUS' PHYSIKALISCHER ATLAS.—Dreizehnte Lieferung. Inhalt: No. 13, Nord-Amerika (Dr. H. Berghaus); No. 19, Seetiefen (Dr. H. Berghaus); No. 59, Schmetterlinge (Dr. W. Marshall).

Gotha: Justus Perthes, 1887. *Price M.* 3.

HANDY REFERENCE ATLAS OF THE WORLD, by John Bartholomew, F.R.G.S., etc. Seventy-six Plates, with Geographical Text and General Index. Crown 8vo. *London: John Walker and Co. Price 7s. 6d.*

The publication of this new work by Mr. Bartholomew marks a distinct departure in the production of atlases. We have been accustomed to associate the "atlas" with a ponderous volume, for the consultation of which it was necessary to clear a table, but in this little volume, as its name implies, we have all the maps that can be wanted for general geographical reference in an extremely convenient and handy form. The maps, which number about 100, are well executed, and appear to have been carefully compiled and brought up to date. Central Africa is now shown as almost all divided among its different claimants, and in the South Polar Regions we find the supposed continent delineated and named "Antarctica." An index and some geographical statistics of the various States of the world, in alphabetical order, complete the general usefulness of the atlas.

SÜDOST-EUROPA, Karte von—: die Staaten der Balkan-Halbinsel, sammt Theilen v. Oesterreich-Ungarn bis Budapest und Wien, und den übrigen angrenzenden Ländern. Redigirt und beschrieben von A. Steinhauser, K. K. Regierungsrath, 1887. Massstab, 1 : 2,000,000.

Wien: Verlag von Artaria und Co. Price 4s. 6d.

CHINESE TURKISTAN, and part of Northern Tibet, illustrating the journey of Mr. A. D. Carey. Reduced from the original map prepared in the Survey Department of India, from the observations of Messrs. Dalgleish and Mr. A. D. Carey. Scale, 1 : 3,600,000.

Proceedings of the Royal Geographical Society, December 1887.

RUSSISCH-AFGHANISCHEN GRENZGEBIETE, Spezial-karte von—: Nach den unter Major T. H. Holdich, R.E., ausgeführten Aufnahmen der Englisch-Russischen Grenzkommission. Reduziert von dem Massstab, 1 : 250,000 auf den Massstab, 1 : 1,250,000.

Petermann's Mitteilungen, Jahrgang 1887, *Tafel* 18. *Gotha: Justus Perthes.*

AFRIKA.—Spezial-karte von ——, in Massstab von 1 : 4,000,000 (or 55·5 geographical miles to an inch), 10 Blätter. Entworfen von Hermann Habenicht, bearbeitet von demselben, Bruno Domann und Dr. Richard Lüddecke. Zweite vollständig neubearbeitete Lieferungs-Ausgabe. Fünf Lieferungen.

Gotha: Justus Perthes. Price M. 18.

The second edition of this great work, the most elaborate and complete general map of Africa at present published, is now finished. In reviewing the first part, in June of last year, we noted the very thorough revision it had received, and the great improvement in the technical execution of printing and colouring. We are glad to add that all the other sheets are entitled to the same praise, and reflect the greatest credit on their compilers and publishers.

In looking over the sheets we find that the greater part of the work has been practically re-drawn. Among the most important changes we note that on Sheet 1 (*West Sahara*), Morocco and Western Algeria have been re-drawn from Lannoy de Bissy's large map of Africa; also that a large area of desert-country, extending from Cape Nun to Cape Bojador, is claimed by Spain, and placed under the Government of the Canary Isles. Sheet 2 (*Central Sahara*) shows a new survey of the Chotts, and a further extension of the Algerian boundary into the desert. On Sheet 3 (*Aegypten*) there is little change, except a better definition of the Egyptian boundary in Arabia. Sheet 4 (*West Sudan*) is much altered as regards political colouring; the French have considerably extended their territory on the Senegal and Upper Niger, and the British on the Gold Coast, Lower Niger, and Binué. On Sheet 5 (*Central Sudan*) the discoveries of Dr. Junker have been incorporated, and the new limits of the German Cameroons Territory are defined; we also miss here the familiar but very hypothetical "Lake Liba." Sheets 6 and 7 (*Congo* and *Abessinen*), we noticed in June. Sheet 8 (*Seengebiet*), shows Emin Pasha's newly discovered river, the Dueru or Kabile, connecting the Albert Nyanza and Muta Nzige; the demarcation of British and German "spheres of influence," extending from the Zanzibar territory, are also shown. On Sheet 9 (*Capland*) the Germans appear to have claimed all the south-western part of Africa that remained after the British took in Bechuanaland. On Sheet 10 (*Delagoa Bai*) we note many new places in the Transvaal that owe their existence to the discovery of gold. The boundaries of the New Republic and British Zululand are also marked.

DER KILIMANDSCHARO.—Eine provisorische Skizze von Dr. Hans Meyer. *Petermann's Mitteilungen, Jahrgang* 1887, *Tafel* 19. *Gotha: Justus Perthes.*

THE FAYOUM and the Raïan Basin, draughted from original surveys by Cope Whitehouse, M.A. Scale, 1 : 500,000.

Proceedings of the Royal Geographical Society, October 1887.

RIO GRAND DO SUL, Originalkarte der südlichen Kolonieen von——, und der Verkehrsverbindungen mit ihren Absatzorten. Nach neuen Aufnahmen von D. H. von Jhering, L. Wertheimer, u. Anderen, sowie mit Benutzung des vorhandenenen Materials entworfen und gezeichnet von Paul Langhaus. Massstab, 1 : 500,000.

Petermann's Mitteilungen, Jahrgang 1887, *Tafel* 15. *Gotha: Justus Perthes.*

NEW GUINEA.—The Jubilee and Philp Rivers and their Tributaries, showing discoveries made by the *Victory* expedition under command of Mr. Theodore Bevan. Scale, 1 : 880,000.

Proceedings of the Royal Geographical Society, October 1887.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

BURMA: THE NEW BRITISH PROVINCE.

Delivered before the Royal Scottish Geographical Society in Edinburgh, Glasgow, and Dundee, November 1887.

By Sir Charles Bernard, K.C.S.I.,

Late Chief Commissioner of Burma.

Burma is a large subject, and what there is time to say in a short lecture may be grouped under the heads of

Geography,
Politics and Population,
Products and Trade.

First, with reference to Geography:—The British province of Burma now embraces all the territory that belonged to the empire of Ava in its grandest days. It stretches from China on the east to the Bay of Bengal for about 600 miles, and from the Patkoi mountains bordering the Brahmaputra valley southward for about 1100 miles far down the Malay peninsula. The total area of Burma is much greater than that of any other province of the Indian empire. Burma with its dependencies covers about 280,000 square miles, of which about 90,000 belong to Lower Burma, and about 190,000 to Upper Burma. The mention of so many square miles does not always convey a distinct impression; so on my map I have given an outline of Scotland, drawn to the same scale as Burma is drawn; and you will see that the province of Burma is about eleven times as large as Scotland.

The country consists of the broad basin of the Irrawaddy river and its tributaries, of the narrow rugged country drained by the Salween river, of the small Sittang valley, and of two narrow strips of territory between

the mountains and the sea, to the north and to the south of the Irrawaddy river, which two strips are called respectively Arakan and Tenasserim. Open and rich plains are found only in the Irrawaddy valley and in the deltas of the Salween, Koladan, and Sittang rivers. For the rest, the province consists mainly of hills and broken country. On the north lie the Patkoi and other ranges which look down on the Assam valley. At one point these ranges are said to reach a height of nearly 12,000 feet; and outliers from these northern hills come down far into the valleys of the Irrawaddy and the Chindwin. Arakan is separated from Burma proper by a chain of hills called the Arakan Yóma, running from Bengal down to Cape Negrais. An immense mass of mountains, culminating in the snow-clad hills beyond the Chinese city of Talifoo, separates Burma from China on the north-east. The whole of the Shan States is, so far as we know, an upland tract, cut here and there by deep clefts, through which wind the Salween and other rivers. Buttresses of the Shan mountain country come close to the Irrawaddy river at the Ruby Mines and at Mandalay. Above the Ruby Mines the hills rise to over 8000 feet; and the mines themselves are situate on an upland plateau 4000 to 5000 feet above the sea. The Shan hills cover the upper basin of the Sittang river, reaching a height of about 7000 feet; and thence cross over to the valleys of the Salween and Cambodia rivers. Then we have lesser highlands, such as the Pegu Yóma, which separates the Irrawaddy and Sittang valleys; the range which forms the back-bone of Tenasserim and of the Malay peninsula; and the remarkable hill of Pópa, which must have been a volcano—it stands alone, rises to a height of nearly 5000 feet, and is visible all across the Irrawaddy valley.

The country is all hilly from the Arakan range to the Chindwin river; from the Chindwin to the upper basin of the Moo river, and from the Moo right away to the Mogoung and Irrawaddy river. Great masses of hills sometimes come right down to the river banks, forming grand precipices such as one sees at the defiles of the Irrawaddy and on the Chindwin. There are broad fertile valleys here and there, such as at Kyouksé, at Woontho, at Mandalay, and at the mouths of most of the affluents of the Irrawaddy. But for the rest the only level plains of the country are the great delta of the Irrawaddy and the smaller deltas of the Salween, Koladan, and Sittang rivers. It is estimated that there are barely 50,000 square miles of level cultivable land in the whole country. The rest of the province is broken up by hills, and is, for the most part, covered with forest. Much of the upland country could be cleared and cultivated. A few small areas in the hills have been terraced for cultivation; and a large area is cultivated under the wasteful custom of the hill tribes, who clear a space in the forest, burn the wood when it is dry, and on the first rainfall cast seed into the ashes. The whole process of clearing, burning, sowing, and reaping takes only eight months; and next season the cultivator passes on to another patch in the forest.

After the mountains the most important physical features of Burma

are its great rivers. First, there is the Irrawaddy, with a course of probably 1100 miles, which is navigable by big river steamers from Rangoon to Bhamo, a distance of nearly 700 miles ; some hundreds of miles of cross channels and deltaic mouths are similarly navigable. The steamers which ply to Mandalay with their flats carry 1000 tons of cargo and several hundred passengers each trip. None of the affluents of the Irrawaddy in Lower Burma are navigable by steamers throughout the year. The Chindwin, which has a course of about 500 miles, is navigable for 150 miles all the year round, and for 300 miles during the rainy season. The Myitngé and the Shwéli are also navigable during the flood season. The Salween and its tributaries are navigable by small steamers for only about 80 miles from the sea ; beyond that distance the Salween river is barred by many successive cataracts and rocky barriers. All these streams, and many more, are in the flood-season navigated by multitudes of native craft, some of which are large enough to carry 120 tons of cargo. Until the railways were opened, the rivers were the only means of transit for goods and produce ; during the dry season, cargo-carrying boats could ply only on the larger rivers or on tidal channels. Probably no goods in Burma ever travelled by carts for a longer distance than 50 miles, save when employed with troops. So over a very great part of the country there could be no movement of heavy goods during seven months of the year.

Owing to the heavy rainfall in the delta and on the mountains, the Irrawaddy and all the rivers of Burma are subject to great floods in the rainy season. At Prome, nearly 200 miles from the sea, and about 100 miles beyond tidal influence, the height of the river Irrawaddy has been observed day by day for twenty-five years, and the difference between the lowest dry season level and the highest rainy season level is 44 feet. In ordinary years the rise is probably about 35 or 36 feet. At the point where these observations are taken the river is about one mile broad. When these heavy floods come down the rivers rise high above their banks and spread themselves over the country. Sometimes the water of the Irrawaddy spreads over a breadth of 20 to 25 miles of delta country. Even at Mandalay, 500 miles from the sea, the river covers a breadth of 5 miles during the rainy season. Many hundreds of square miles that used to be flooded yearly to a depth of 4 to 10 feet have been protected by embankments made during British rule, and behind these embankments great areas have been cultivated by rice-growers. But in the tracts not so protected hundred of villages are submerged for a few weeks of every year. People living on islands or on very low-lying lands leave their homes, and go elsewhere during the flood season. But in most delta villages the people merely move up to their upper story, and at worst are driven to their garrets for a few days at a time. The houses are all built on piles ; the flood waters move very slowly and gently, when they spread over the country. And the people, being prepared for the yearly floods, do not seem to suffer. Every house has a boat or canoe ; every man, woman, and weaned child can swim ; and, if the baby by chance rolls

off the verandah or tumbles out of the window into the water below, the mother or grandmother dives after it and picks it out.

The rainfall varies widely in different parts of Burma. Along the coast at Akyab, Kyoukphyoo, Sandoway, Moulmein, Tavoy, and Mergui, the average rainfall, as registered for many years back, exceeds 200 inches a year. At Bassein, Rangoon, and Pegu, a little way inland, it averages 100 inches. Up the broad Irrawaddy valley the rainfall decreases rapidly, till at Prome it is 42 inches and at Thayetmyo it is only 37 inches. Information regarding the rainfall in upper Burma is meagre. But, so far as we can judge, there is a dry belt with only 30 inches, or under, of rain a year from Thayetmyo to Myingyan. Then as the hills get nearer the river, the rainfall increases to about 45 inches at Mandalay; to about 60 inches at Katha; and perhaps to 80 inches at Bhamo. On the upper Chindwin, at the Ruby Mines, along the base of the Shan hills and in the narrow valleys of the Salween and Sittang the rainfall is heavy. These great variations of rainfall cause corresponding differences in the agriculture and the ways of the people. For instance, about Myingyan, Pagán, and the dry belt, the rice fields of the Lower Burma give place to fields of cotton, millet, and pulse, such as are seen in the drier parts of peninsular India. Near and above Mandalay rice again appears as the staple product.

Lower Burma has all been surveyed topographically; over the open country a careful cadastral survey has been in progress for the past eight years; the forests are being surveyed by the Forest Conservancy staff; and careful charts of the coast have been made by the Marine Survey. So we have very fair maps of the country, and we are gradually getting still better ones. Until the year of 1886 our maps of Upper Burma were based on observations made by Captain (now Colonel) Yule and other travellers. The Government of India told off three survey parties to begin on the new province in 1886; but the country was not quiet enough; and the regular survey of Upper Burma has yet to be begun. Still we know a good deal more than we did. Commander Carpenter of the Royal Navy, with a detachment of the Marine Survey, took careful observations, and published a chart of the Irrawaddy river from the old frontier to Bhamo, with all the channels marked. For more than eighteen months a small party of picked Survey officers have made their headquarters at Mandalay. They have fixed by careful sidereal observations the position of Mandalay, Bhamo, the Ruby Mines, Kendat on the Chindwin, the Popa peak, and Inlé on the Shan plateau. The railway survey has been carried over a belt 240 miles long from Toungoo to Mandalay. From Munnipore a skilled officer of the Survey came *viâ* Tummoo to the Chindwin, and so linked the Upper Burma observations to the older surveys of the Assam valley. And every military column that has gone out has brought back more or less serviceable maps of the country traversed. No one, who has not seen the work of this kind done by officers of our army of late years, would believe what excellent sketch-maps young regimental

officers furnish of the country crossed by flying columns. All the geographical material thus collected has been worked into our maps by the Intelligence Department and by Major Hobday, who superintends survey work at Mandalay; and he issues a revised map of Burma, with additions up to date every eight months or so. I have here the last map issued this year, with all corrections up to February 1887. The points fixed by Captain (now Colonel) Yule, during Major Phayre's diplomatic visit to the Court of Ava thirty years ago, have been found very correct.

Many interesting geographical explorations have still to be made. For instance, we have to prospect the route between the upper Irrawaddy and the upper Brahmaputra, which route was once travelled by Dr. Griffith sixty years ago. Some messengers from Assam came that way in April last; they report that the path is now used by traders; and they found the Kachins or Singphos in that region tolerably friendly to strangers. We have to explore the country between the Chindwin and Mogoungrweis, and to verify the navigability of the Shweli. The greater part of the Shan States is still an unknown land. British officers have recently reached only to Thebaw on the north, and to Inlé and Moné on the south. The only civilised person who has seen much of the interior of the Shan country is the Rev. Dr. Cushing, who has translated the Bible into the Shan language; and even he has seen little of the States beyond the Salween river. We have also to solve doubts regarding the early course and the source of the Irrawaddy. Our geographical knowledge on all these points will be much fuller a few years hence. During next month the 44th Goorkha Regiment will march from the Ruby Mines back to their home in Assam, across the headwaters of the Moo river, along a route that has never, so far as I know, been traversed by a European.

I must now pass on to the second section of the subject, namely—

Politics and Population.

The Government of India have at present external relations through Burma with only two foreign nations, namely Siam and China. With Siam, British Burma has been conterminous for sixty years. The Siamese empire has proved itself a friendly, intelligent, and peaceful neighbour. She has connected herself with Burma by two lines of telegraph; she has removed restrictions on British commerce; she has welcomed the establishment of a British Vice-Consul at Zimmé on the upper waters of the Siam river; and she is ready to discuss schemes for railway connection in a liberal spirit. So long as Siam remains an independent power, we may safely reckon upon her being a friendly neighbour to Burma, and on her co-operating readily with the Indian Government for the furtherance of British trade.

With the great Empire of China, British Burma had no direct relations until 1886, though many Chinese immigrants are settled in the province, and doing useful work as traders, carpenters, market-gardeners,

and tin-miners. But since 1886 the British frontier has marched with China for more than 500 miles on the north-east of Burma. Much of this border lies among unexplored mountains, inhabited, if at all, by wild races. The boundary between Shan States subject to Burma and Shan States subject to China was not very clear in parts. And there was an indistinct idea that China had claimed—perhaps even that the Burmese had paid—some kind of fealty in past times. A little further east claims of this kind had led to a bitter war between France and China. And the acquisition of Upper Burma, even if otherwise desirable, would have been purchased far too dearly, if it had involved Great Britain in a quarrel with China. So it was a very great relief when Her Majesty's Government concluded a convention with Pekin, whereby China recognised the Queen of Great Britain as Sovereign of Burma, agreed to a joint delimitation of the China and Burma boundary, and engaged to discuss on the spot means for facilitating trade between Burma and Western China. The delimitation has yet to be effected, and steps for promoting trade have to be devised and carried out; but these matters will be settled before long; and meanwhile it is most satisfactory to know that there is no risk whatever of Burma being a cause of quarrel, or even of coldness, between Great Britain and China.

The relations of Burma with the Shan States are of a political character, though these countries are dependencies of Burma. The Burmese records used to speak of 99 separate Shan States. We find there are 24 larger States, besides 30 or 40 smaller chiefships. Some years ago the King of Ava used to get a substantial tribute from, and to exercise a real authority over, these States. But for some time before the recent war the King of Burma had been fighting with the Shans. There was more or less of anarchy all over the Shan country. Each State that was not fighting the Burmese troops was quarrelling with its neighbours; and some of the far-off States near the Cambodia river had entirely thrown over Burma dominion, killing the Burmese officials who were stationed in those parts. The Shan States occupy a large part of the Upper Burma territory; they are estimated to contain about two millions of people. The Shans are the chief customers for British goods in the Mandalay market; and so their attitude was very important. At first they held aloof from us, believing that we should not stay in the country. For some months our hands were very full with the affairs of Burma Proper; and we could not spare troops or carriage necessary to escort an officer who should visit the Shan States. It was known, however, that the Shans much disliked Burmese domination; and it was believed they would accept British supremacy. Meanwhile the Shan States and petty chiefs were fighting freely among themselves. Sundry fugitive chiefs, who had been dethroned by King Thebaw, took the opportunity to get their own again, and to eject, not without fighting, the usurpers. Towards the middle of last year the authorities at Mandalay received urgent requests that a British force should be sent up to restore quiet, and stop civil war

in the Shan highlands. These requests came from the central and southern chiefs of Nyaung-ywé, of Mobyé, and of Karennee.

About the same time very friendly advances were received from Thebaw, the principal northern State. The chief of Thebaw had been driven out by the late King, and sought asylum in Lower Burma. While living in retirement near Rangoon, he shot two of his attendants, who, as he believed, had been bribed by the Mandalay Government to poison him. For this offence he was tried by the Rangoon Courts, convicted, and sentenced to death. This sentence was commuted by the Executive Government; and, in consideration of the ex-chief's antecedents and circumstances, he was released, after a year's imprisonment, on condition that he left British territory. After some hardships the ex-chief got back to his own territory, and, on the fall of the late King, regained power in Thebaw. On several occasions he was invited by Burmese pretenders, by other Shan chiefs, and by Chinese freebooters, to join in driving the British out of the country. He invariably replied that he was a friend to the British, and would do nothing against them, because they had given him asylum when he was a refugee, and when his life was forfeit to their laws they had spared him, released him, and enabled him to regain his throne. This chief, in response to our invitation, came into Mandalay, and made his submission to the British authorities, who received him well. When he returned to his capital, a British officer with a small escort went back with him, to prospect the country. The far-sighted gratitude of this chief was really remarkable; his advisers and ministers were strongly against his coming. One day at Mandalay he and some of his followers were taken for a cruise on the river in a steamer, and his old Prime Minister said to him, "Now, you see what we prophesied is coming true; these treacherous foreigners are carrying us off to the sea." The chief, however, trusted us throughout. Most of the Shan chiefs distrusted our advances. In Burman times the chiefs used to be enticed into Mandalay, and when they came they were either detained or beheaded. They expected the British to act as did the Burmese. I believe the conduct of the Thebaw chief and his favourable reception by the British have had and will have much effect on the Shan States.

In January last a small column of troops moved up to the Shan plateau to relieve the friendly chief of Nyaung-ywé, who was beleaguered by a hostile confederation. Despite the difficulties of the mountain paths, the column got up in time to relieve the friendly chief. A single encounter, with no loss on our side and very little loss to the Shans, sufficed to break up the confederacy. In a few weeks the Burmese pretender, who had been the head of the confederacy, surrendered, and submission was made by some of the Shan chiefs around. A political officer, with an escort and a fort, has been placed at Inlé; from that centre the political officer has made sundry visits to chiefs; and we may hope that the Shan States will be gradually pacified and brought under British influence. It will take some years to effect this result; but in the

end it will be done. Roads up the passes, and means of communication between the Shan States and the railway line at the base of the Shan hills, will be among the most effectual means of pacifying the country. The Burmese policy was to break down and disintegrate the larger and more powerful Shan States. The British policy is to strengthen the larger States, and to lay on them the responsibility of maintaining peace and guarding the traffic routes throughout the country.

It may be that in time to come we shall find ourselves in contact with France in the far-off eastern Shan States, which are astride the Cambodia river, about latitude 22° and longitude 101°. The French are feeling their way westward and northward from Tonkin in that direction. The most easterly point of the Shan States is not many miles from the Hoti river, a feeder of the Tonkin river, and is about 300 miles in a direct line from the Tonkin seaboard. If the remote dependencies of these two great European nations should hereafter touch each other, the rulers of that day will know how to turn such contact to peaceful ends, and to the commercial advantage of both countries.

The population of Lower Burma we know to be about $4\frac{3}{4}$ millions; and we estimate the population of Upper Burma, inclusive of the Shan States, to be at least 4 to 5 millions. Thus the population of Burma and its dependencies would be about 9 millions in all. Probably this total might be distributed somewhat thus:—

Burmese,	$5\frac{1}{2}$ millions.
Shans,	2 ,,
Karens,	$\frac{3}{4}$,,
Kachins, Chins, and other wild tribes,	$\frac{3}{4}$,,
Indians, Chinese, and Europeans,	$\frac{1}{4}$,,
Total,	$9\frac{1}{4}$ millions.

The Burmese are by far the most numerous and most important. They and the Shans are Buddhists by religion. The Burmese are naturally excitable and impulsive: up to a certain point they are often very courageous; they are proud, very proud of their race; they love their country and their religion. Burmese youths are generally ready for a riot or a fight. They look upon robbery with violence, or dacoity, as it is called, as a pastime; and a successful Burman dacoit is a powerful and influential personage in his neighbourhood. Burmese ladies help to keep up the respect for dacoits; they pay much consideration, and give valuable help to dacoit bands; and it used to be said that no Burmese maiden would smile upon her lover until he had shown his manhood in a dacoity or two. For some years before the war of 1886 there had been anarchy and absence of rule in parts of Upper Burmah; the old village polities had been much pressed out, and the Burmese officials were too corrupt or too weak to maintain any administrative system. And so, when the Burmese troops were defeated by our forces, and the King collapsed, the country became

overrun by guerilla bands, recruited from the disbanded soldiers, from the bad characters that exist in Burmese as in other communities, and from all the young men throughout the country-side. Religious feeling, as well as love of country, had doubtless much to do with stirring up the people to a guerilla warfare against us. For the Buddhist monks really feared lest the British would subvert the national faith; and they are only now coming round to believe that no interference with their religion is intended or will be attempted. The guerilla warfare will be—indeed it has in great part—stopped; but I fear that for a generation or so to come dacoity, that is, robbery with violence by marauder bands, with occasional looting of villages, will continue to be a feature of social life in Upper and Lower Burma. But the Burmans are not all, or nearly all, dacoits. In the deltas of Lower Burma, and in the open country of Upper Burma, the Burmese are industrious and successful cultivators. The delta districts grow rice enough for themselves and their neighbours, and they also export annually out of the country more than one million tons of rice—that is to say, more than half the gross rice crop, more than twice as much as the rice export from continental India, and about three times as much as the whole Siamese empire. The Burman is often said to be a lazy fellow, but when he can produce an enormous surplus like this, when he can pay for nearly six times as much imported goods per head as his Indian brother, when his country supports an external trade of the value of about £4 per head of the whole population, I do not think the Burman can be fairly rated as a lazy good-for-nothing.

In one important respect the Burmese are far ahead of their Indian fellow-subjects. Every village has its one or more monasteries, where the Buddhist monks devote their time to teaching the young. Every Burman lad must pass a longer or shorter time of his boyhood as a pupil in some monastery, and learns there to read and write. In Lower Burma, where monastic schools have accepted Government inspection and are recognised as the national primary schools, boys learn a good deal more than reading. By last census the proportion of males able to read and write in lower Burma was four or five times as great as in continental India, and was even larger than in some of the countries of northern Europe. Elementary education is much less universal among Burmese women, for the strict rules which guard the celibacy of monks forbid the admission of girls to monastic schools. Still the women of Burma have a much happier life than their Indian sisters; they come out, mix in society, do marketing, keep shops, and generally have as large a share in domestic and social affairs as women in Scotland. Burmese girls are not married in childhood like Indian girls; they settle those matters themselves with young people of the other sex. A Burman widow can marry again as soon as she gets a chance. Among other results of the freedom allowed to women in Burma, as compared with India, we find that the proportion of women to men prisoners in jails in Burma is less than one-third of the proportion in India; and while in India the number of women suicides is

more than double the men suicides, we rarely hear of a woman suicide in Burma.

The Burmese, women as well as men, are a cheery, laughter-loving race: greatly enjoying dramas and shows of any description; and always ready for fun of every kind. Nobody who sees much of them can help liking them. One great reason for the comfort and cheerfulness of a Burman, as compared with an Indian, household is that the people are much better off in Burma. The average wages or earnings of a labouring man in Burma are about four times as high as an Indian labourer's earnings. The cost of absolute necessaries is about the same in each case: but a Burman's diet is much more generous than an Indian's diet. One main cause of the high wages in Burma is that there is plenty of good land to be had for the asking, on payment of a moderate tax, and wages have to be kept at about the rate a man can earn by tilling his own land. There are no landlords in Burma, and waste land can be obtained from the village officials on clearance grants. Usually an intending settler serves for a year or so as farm labourer on some petty holding; then he cultivates part of a neighbour's plot on the half-profit system: and after two or three years he has saved enough to buy a pair of bullocks, and clear a few acres for himself. He does not pay any tax until the third or fourth harvest; and he pays only $\frac{1}{12}$ of the full tax on any part of his holding that he may leave fallow. The full land tax is about two rupees, or three shillings per acre, while the value of the rice crop on an acre is about twenty rupees or thirty shillings on the delta lands, where the yield averages thirty-five bushels of paddy (rice with the husk unremoved) to the acre.

It is a peculiarity of Burma that, while there is a generally high level of prosperity, there are no very rich people, there are no big landlords, there are no nobility, and no aristocracy save the officials. Occasionally a man makes a fortune by successful dealings in rice or timber; but the Burmese are open-handed in their expenditure; and the fortune is spent by the gainer or his sons. The most respected and influential class of the community are the Buddhist monks, of whom there may be 6000 in Lower and 15,000 to 20,000 in Upper Burma. Burmese monks, for the most part, keep their vows of celibacy and poverty very strictly. One great safeguard is that they can always throw off the yellow robe of monkhood and return to ordinary life if they have fallen in love, if they are tired of religious duty, or if for any other reason they desire to return to the world. The monks are supported—and very well supported—by their parishioners; they own no property, and enjoy no endowments. But the beautiful monasteries and pagodas which adorn every village and town, and which cannot fail to attract the attention of every traveller in Burma, testify that the Burmese have spent, and are still spending, very large sums on religious objects.

Next to the Burmese the Shans are the largest section of the population. Their religion, their customs, and in some degree their character,

are the same as those of the Burmese. But the Shans, being a mountain people, are poorer, live hardier lives, and are less merry than the Burmese. The Shans also are more persevering, more enduring, and perhaps more courageous. They are wonderfully apt traders and pedlars. The way in which a few Shans marshal a caravan of some hundreds of pack bullocks, and bring them without a mishap four months' journey from China to Mandalay and back, over mountains and through forests, is admirable. This aptitude and inclination to trade on the part of the Shans warrants a confidence that, when the Shan country is pacified and opened out, the men of this race will carry British goods from our railway stations all over the Shan and Laos States, and right into the markets of Southern China.

The Karens are found in Lower Burma only. They used to be nature-worshippers, and were much oppressed by the Burmese, whom they dislike and fear. They sided actively with the British authorities during the troubles after the annexation of Pegu in 1854; and they did excellent service during the rebellion of last year. They live mainly by agriculture. Some of them are good foresters. The Karens are more shy and retiring than the Burmese; they are less excitable, and not so clever. But they are steadier and more trustworthy than the Burmans. For instance, at the railway workshops near Rangoon, where technical training is given, we have never yet got a Burman lad to serve for a couple of years, whereas we always have thirty or forty Karen apprentices; some of these Karen youths have already done their five years' apprenticeship, and are making capital fitters and artisans in the shops. Some people think that the future of Burma will be for the Karens. However this may be, no doubt the Karens are an important and valuable section of the population. The most interesting fact about the Karens is, that large numbers of them have embraced the Gospel as preached to them by the American Baptist missionaries. And there are now in Burma about 600 settlements or parishes of Christian Karens; each such parish maintains at its own cost its own church, its own pastor, and its own school. And this is now done without any money from the funds subscribed in America, and with only a minimum of supervision from the American missionaries.

Regarding the other hill-tribes we know comparatively little. The Chins inhabit the hilly country between the Arakan Yoma and the Chindwin. Some of the mountain Chins have for years past raided habitually upon the villages of the Kuboo valley south of Tummoo. They burn, kill, and carry away captive in very ruthless fashion. The taming of these wild Chins is one of the tasks before the administrators of the Chindwin country. Small colonies of Chins are found in the Prome, Henzada, and Sandoway districts of Lower Burma, where British officials occasionally come across them. Two American missionaries have been working for some time among the Chins, have reduced their language to writing, have taught some of them to read, and have printed

a few Chin tracts. The Chins tattoo their women's faces. The custom is said to have originated from a wish to save their girls from being carried off by Burmans; and certainly the tattooed women look most unattractive. It is remarkable that so barbarous a custom should have lasted through thirty years of British domination.

The Kachin tribes stretch from the Shan country round Bhamo, and thence across to the Assam hills, where they are known under the name of Singphos. They are courageous and skilful defenders of their mountain fastnesses; they are reputed to be notable robbers; and they levy blackmail on some of the trade routes to China. This year, to the astonishment of the Burmese, several hundred of the Chins came into Bhamo and worked steadily under British engineers on the barracks, roads, and town improvements. American missionaries, who are labouring with some success among the Chins near Bhamo, have sojourned for weeks, and been kindly treated at Chin villages in the hills. And it seems probable that these people will respond to kind and just treatment, which they appear not to have received at the hand of the Burman officials. We hope to enlist Chins into the levy which guards the Mogoung frontier; for they can stand the climate of those forests, which to Indians and ordinary Burmans is deadly.

Of the Paloungs we only know that they inhabit the Theinnee State in the northern Shan country. They are a quiet, retiring race. They collect and prepare the indigenous tea of those hills; a great quantity of this tea-leaf is eaten in the shape of pickled tea throughout Burma. The Karennees or Red Karens live in the Karennee country which for many years was practically independent of Burma, of Siam, and of the Shan chiefs. They have been always friendly to the British. They are esteemed to be the most warlike and courageous of all the races of Burma; and they vindicated their right to this repute in encounters with Shans, Chins, and Chinese during 1883 and 1884. They are skilful foresters.

The third section of our subject is

PRODUCTS AND TRADE.

The staple industry of the country is agriculture, and about three-quarters of the working people are employed more or less directly on the soil. The remaining quarter are fishermen, boatmen, foresters, traders, shopkeepers, and craftsmen of different kinds. The one great product of Lower Burma is rice. Some teak timber is obtained from the forests, which were exhausted in former years, and are now being carefully conserved. A little tin is manufactured by Chinese immigrants in the southern districts. A small quantity of petroleum is raised in Arakan for local consumption. Efforts to work tin and petroleum on a large scale, after European methods, ended in failure and in loss of all the capital embarked on those undertakings. A moderate quantity of cutch (a gum used for dyeing, for tanning leather, and for preserving fish-nets) is produced in Lower Burma. There is coal in the country, but attempts at

working have shown it to be in small quantity and of poor quality. Copper is found, and lead exists in great quantity. But the copper cannot be worked to advantage, and the world's demand for lead seems to be small. At any rate, the company who tried to work the lead of the Youzaleen valley had to give up the undertaking, though lead is found close to the surface in an almost pure state.

Rice is the product by which Lower Burma prospers, and rice occupies six-sevenths of the cultivated land of Lower Burma. The value of the rice exports of last year was about six millions sterling. There are forty rice-mills constantly at work at the rice-ports during the season. The mill-owners buy the rough paddy from the rice-growers, and convert it into the product required by the markets of Europe and China. The presence of these mills, ready to buy all paddy brought to market, ensures to the farmer the top price which Europe prices of the day admit. Exported rice pays a duty of about 7½ per cent. *ad valorem*. This duty is contrary to the principles which govern fiscal affairs in India and in the mother country. But the Indian Treasury cannot dispense with the half million sterling yielded by the rice duty; and as the duty is about the same on rice exported from Burma, from Bengal, from Saigon and from Bangkok, Burma trade does not suffer seriously from the impost. Nearly all the rice-exporting tracts of Burma have river or railway communication with the rice-ports. How far the rice-growers benefit by the rice-mills may be gathered from the fact that rice-growers near Toungoo or the upper Sittang could, up to 1885, get only 20 or 25 rupees per hundred bushels for their surplus paddy; whereas, when the railway opened over the 165 miles between Toungoo and Rangoon, the growers were practically brought to the doors of the rice-mills, and the Toungoo price rose to 50 or 60 rupees per hundred bushels.

The total area of cultivated land in Lower Burma last year was four and a half millions of acres, or about 7000 square miles. Probably 5000 to 6000 square miles may be under cultivation of some kind in upper Burma. This would make 13,000 square miles in all of land under crop; so there is ample room for the extension of cultivation. In Lower Burma the area under the plough has of late years increased by about 100,000 acres every year, and between the two last censuses the population had increased at the rate of four per cent. annually. The races of Burma are more prolific and more healthy than the people of India, partly because their diet is more generous, and partly because boys and girls do not marry there at a very early age as they do in India. When fertile land, close to good markets, is plentiful in Burma, it seems strange that immigrants do not come thither from the over-peopled districts of India, where the mass of the people live very poorly indeed. During the past fifteen years the Government have, on four separate occasions, and under four different systems, made strenuous efforts to promote such immigration. Expenditure was not stinted, but the attempts altogether failed. Indian families, even among the very poorest classes, are most loth to leave their

old homes, and young men who go to Burma as labourers mostly return home again. In the year 1883, when Government paid a part of every Indian immigrant's passage to Burma, the province received as many as 86,000 immigrants, but very few of them brought their families or made permanent settlement there. Last year's returns show that 56,000 immigrants came from India to Burma, while 51,000 returned from Burma to India; so the province kept barely one-tenth of the immigrants. Yet the steamer companies give substantial encouragement to immigrants to stay in Burma, as they charge 16s. for the return fare from Burma, against only 8s. for an Indian going to Burma.

After agriculture, the next most important industry in Lower Burma is the fishery industry. A good deal of fish is caught along the coast, but the bulk of the take of fish is from the rivers and inland waters left by the river floods. Some part of the take is eaten fresh, but the most part is dried or salted. From Lower Burma to Upper Burma about a quarter of a million sterling worth of dried and salted fish used to be exported annually, and the value of the harvest of the waters in Lower Burma probably exceeds one million sterling per annum. The rents or taxes paid to Government by the fisheries used to reach £100,000 a year; and Burma is perhaps one of the few parts of the British dominions where the public treasury draws a large revenue from fisheries.

While the products of Lower Burma are confined to two or three staples, the products of Upper Burma will probably prove to be much more numerous and diverse. There are considerable rice plains in the irrigated tracts of Kyouksé, Mandalay, Salen, and Toundweingyee; but at present the upper province does not produce enough rice for its own use, and it takes from Lower Burma about 100,000 tons of rice yearly, equal to the food of about half a million people for the year. Some years ago Upper Burma used nearly to feed itself, and in 1881 or 1882 it imported only 5000 tons of rice. Upper Burma exports many thousand bales of cotton to China, and it produces wheat and pulse for export. I believe that the opening of the railway to Mandalay, the plying of steamers on feeders of the Irrawaddy, the making of roads, the maintenance of order, and the cessation of vexatious customs duties and transit dues will, during the next ten years, cause an immense increase of agriculture in Upper Burma.

But the most important products of Upper Burma will probably be other than those of agriculture. For some time past Upper Burma, including Karennee, has practically supplied the markets of the world with teak—a timber which for ship-building, for railway carriages, and for most domestic purposes, is probably superior to any timber in the world. In past times Upper Burma has exported about one million sterling worth of teak yearly. The vast and partly explored forests are believed to contain large stores of teak. Under the British Government careful, systematic conservancy is being introduced into the forests, and a generation hence Burma will have established a reserve of teak sufficient for the world's needs. Under the Burman Government the teak forests

were being wastefully exploited, without any regard to conservancy or reproduction. One good result of the annexation of Upper Burma will be that the teak sources of the world will be conserved and improved instead of being squandered.

Among other forest products the most important are cutch, a gum largely used in trade; rubber, of which a considerable export takes place annually; and wild tea. This tea grows on the hills of the Shan State of Theinnee. It is not used for drinking as an infusion. The tea-leaves are pickled in salt water, allowed to ferment, and then eaten as a condiment with rice, fish, and food of all kinds. Pickled tea fetches a high price. King Thebaw used to make a revenue of £80,000 a year by leasing the monopoly of pickled tea. The British Government have abolished the monopoly; so the trade ought to increase greatly. With a larger export of pickled tea, of teak, and of ponies—which are the hardiest and best animals of the kind in the East—the Shans will be able to pay for a larger quantity of imported commodities of many kinds.

The mineral products of Upper Burma are various. Iron, copper, lead, gold, and silver all are found. It will not pay to work the iron, copper, or lead. Supplies of these metals can be got cheaper from Great Britain or the colonies. Gold has not been found in workable quantities, though a little has been produced from washings of river sand. Hitherto Burma has drawn its supplies of gold-leaf from China, and of other gold from the sea-board. Silver has not been largely worked for some years; but it is said to be found in quantity at several places in the Shan States. The most important mineral product of the country will probably be its coal. We know of three distinct coal-fields—one close to the railway; another on the Irrawaddy, half-way from Mandalay to Bhamo; and a third on the Chindwin. As yet the Chindwin coal is being worked only for the use of steamers on that river. All the steamers, locomotives, and engines in Burma at present use English and Scottish coal; but in a few years' time Burmese coal will be largely used, especially in Upper Burma. The Chindwin coal-field and the field near the railway have been examined by the Geological Survey; at the Chindwin the coal is reported to be of good quality and in great quantity; but the coal near the railway, so far as seen, was not good; the Surveyor, however, advised further explorations.

Close to Mandalay there are quarries of excellent white marble, which has long been used for statues of Buddha and for ornamenting pagodas. The chief source for the supply of jade to the markets of China and Japan is in Upper Burma, near the head-waters of the Mogoung and Ooroo rivers. The traffic in jade is in the hands of Chinese, who pay a royalty of about £5000 a year for the jade they export. At present the carriage of the stone from the quarries to a navigable river is tedious and costly.

The products of Upper Burma about which there has recently been most talk are its rubies. Good rubies are among the most costly of precious stones. Weight for weight, they are worth much more than diamonds; and flawless rubies of any size are very rare gems. The

Burma mines are the only source in the world for rubies of the finest colour. Formerly the mines were worked in the most rude and desultory manner; about £100,000 worth of rubies were imported from Burma annually, and the highest royalty that the King ever got from the royalty on the rubies was about £12,000 a year. The ruby-yielding area stretches over nearly 200 square miles; and small rubies, or ruby dust, can be found at a number of places over that area. But large rubies are very rare. They can be easily secreted by the finders, and smuggled away without payment of royalty. A London syndicate, with Mr. Streeter, of Bond Street, at their head, offered to take a short lease of the Government rights in the mines, to work the mines with modern mechanical appliances, and to pay a royalty of 400,000 rupees, or £30,000 a year. The lease has not yet been completed. It may be that when skilful working is introduced the yield of rubies will greatly increase. The African diamond-fields have, under European working, yielded, it is said, forty millions sterling of diamonds during the past fifteen years, and now produce two millions' worth yearly. It may be that the world will not absorb so many rubies as it does diamonds; and if Government tried to work the mines themselves, there would be risk of their overloading the market. It will certainly be better that practised specialists should direct the operations, and develop the mines at the outset. After a short lease by experts, it will be possible to ascertain what the royalty on rubies ought to yield to the public treasury.

Upper Burma possesses an oil region whereon earth oil or petroleum has been raised for many years. This oil is a thick, dark, viscous fluid, very unlike the clear oils of the Arakan oil-field. The oil is raised mostly from some 500 wells near Yénangyoung (a Burmese name meaning "oil-city"). None of these wells are more than 200 feet deep. Nothing in the shape of a springing well, or of a large constant flow from any one well, has yet been discovered in this oil region. Good wells yield about forty gallons of crude oil a day. Formerly this oil used to have a large local market, and fetched a good price. Now some millions of gallons of refined American oil come into the Burmese market; and the selling price of the local oil has fallen sixty per cent. At present the main purchaser for crude Burman oil is a refinery established at Rangoon by a Glasgow firm, who have obtained considerable concessions of the Government rights in the oil region; and it remains to be seen whether this company, by introducing machinery and skilful supervision, can secure a large output of oil. If they do this, they will perhaps transfer their refinery to the oil region, as the waste on the crude oil is about 80 per cent., and the cost of carriage to Rangoon is considerable. As yet the market for products made from the oil-waste has not been good. If a large continuous yield of oil is secured, the undertaking ought to be remunerative to the company and very beneficial to the oil region. There is ample room for the extension of the oil industry outside the areas over which the company's concession extends.

In past times the external sea-borne trade of Lower Burma has been about 180 millions of rupees, or say 14 millions sterling a year; and the trade with Upper Burma has been about 50 millions of rupees, or 4 millions sterling. So active is the internal traffic of the province that the first railway opened in Lower Burma paid a dividend of 4½ per cent. within five years of its opening. The second railway has been opened for two years; and that too will certainly pay 4½ per cent. within five years of opening. It is not easy to say what the trade of Upper Burma may reach. We have seen that the country, besides its agricultural produce, and a good supply of coal, possesses what are the chief, if not the only, sources in the world for the supply of teak timber, of rubies, and of jade. At present, Upper Burma is not nearly paying its way, but is a serious drain on the finances of the Indian empire. About twenty-seven years ago, or six years after Lower Burma had become a British possession, the province was not paying its way, and yielded a gross revenue of less than three-quarters of a million sterling. Since that time the prosperity of Lower Burma has increased very rapidly; the population has more than doubled, and so has the area of rice crop; the trade has quadrupled; the gross revenues are now two and a half millions sterling; and the province yields a yearly surplus of about a million to the Indian exchequer. When the country is quiet, when railways and roads are made, when steamers are multiplied, when good communications are established with China, with Assam, and with Siam, and when the Shan States are opened out—there is no reason why the population, prosperity, trade, and revenue of Upper Burma should not increase in something like the same ratio as in Lower Burma. The history of nearly every Indian province, which the British have annexed during the present century, has been that for the first few years the province costs a good deal, and little revenue is got out of it; for we begin by abolishing customs duties, transit dues, and other sources of revenue which cramp trade and annoy the people. But after a few years the old sources of revenue improve, new sources arise, and trade is created under a firm and just administration. I believe that the course of affairs in Upper Burma will be the same. If the new part of the province improves in any degree as the old one did, then the united province of Burma will, twenty years hence, be for its population by far the most comfortable, the most prosperous, the most educated, the most revenue-paying, and the most go-ahead section of the great Empire of British India.

After the Address,—

Dr. GEORGE SMITH, in moving a vote of thanks to Sir Charles Bernard, spoke of the energy and ability which had characterised, and the success which had attended, his administration in Burma; and complimented him upon the completeness of the picture of Burma which he had presented in his address. He said he should have liked Sir Charles to have referred to the railway scheme

with which the names of Mr. Colquhoun and of Mr. Holt Hallett were associated, and also to the Burmese capitation tax.

Mr. Henry Soltau, in seconding the vote of thanks to Sir Charles Bernard remarked that, from his own experience and observation in Burma, he had been struck by the accuracy and the wonderful grasp of his subject which the lecturer had shown. Sir Charles had not only been an admirable administrator, but he had also got hold of the affections of the people in a most remarkable way. He never heard a native say a single word against Sir Charles.

The motion was heartily adopted.

Sir Charles Bernard, in acknowledging the vote of thanks, took up the two points to which Dr. Smith had referred. He very greatly admired Mr. Colquhoun's energy and perseverance, and considered that both he and Mr. Holt Hallett were entitled to very great credit for what they had done to survey the routes to China, and to bring prominently before their countrymen the subject of railway communication between Burma. They advocated a route through Siam and the Eastern Shan States into the extreme south of the Yunnan province; and advised that a railway by that route should be guaranteed by the British Government. So far as his own opinion went, however, he should think it very doubtful whether the British Government could take upon itself to guarantee and protect a railway which passed for a considerable portion of its length through a foreign country, Siam. Siam would probably say there was only one condition upon which she would permit the British Government to make, guarantee, and protect a railway through her territory—namely, that Britain should guarantee the whole Siamese empire from all and every enemy whatsoever. He did not think the British Government could take upon itself the responsibility of guaranteeing Siam against all her enemies. We were in risk of collision, sooner or later, with a great European Power on the north-west of India, and we ought not to undertake responsibilities that might bring similar risks on the south-east. The Indian treasury could not bear, and the Indian army would not suffice for, such a burden. A railway is now being made, and will be open within eighteen months, to Mandalay; that line will doubtless be continued to Bhamo, 700 miles from the sea, and 35 miles from the border of China. The ancient route of traffic between Burma and China was by Bhamo and the Irrawaddy valley; we ought to make the most of that route, and exhaust its possibilities, before we committed ourselves to creating another and wholly new route. No doubt the lofty passes on the old path between Bhamo were most serious obstacles to a railway on that route. But it might be possible to find much easier gradients if the Shweli valley, and other valleys leading towards Sunningfoo, instead of to Talifoo, were examined. A thorough examination of the country would take one or two seasons. By the convention with China, the Pekin Government and the British Government are bound to discuss plans for improving intercommunication in that direction; and the joint commissioners of Britain and China will doubtless carefully consider the railway question. A railway to China, by the Irrawaddy valley, would develop British territory throughout its course. and could be defended without extra troops or extra expenditure. We must always remember that, when the railway reaches the confines of Yunnan, either by Mr. Colquhoun's route or by the Irrawaddy valley, its terminus would still be 500 miles or so from the populous parts of Szechuen; and the success of the line would depend on the Chinese making a railway of that length over the rugged highlands of Yunnan. No one can predict the time when China will be opened out by railways. When that time comes, it will probably be found,

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Kachin
Shillong
Cherrapunji
Jumulpur
Silhet
Surma
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Silchar
Kachar
Mumpur
Dacca
Agartola
Hill Tipperah
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Burrisaul
Jeacolly
Blue Mountains 1850
Chittagong
Mouths of the Ganges
Kutubdia I.
Moscal I.
Elephant Pt.
Shapuri I.
St. Martin's I.
Arakan
Akyab
Kuladan R.
Tiger Pt.
Combermere B.
Ramree I.
Cheduba I.
Sandoway
Foul I.
Bluff Pt.
BAY OF BENGAL
LOWER BURMA
UPPER BURMA
Bhamo
Momeit
Ruby Mines
Kyan Shyat
Theinnee
MANDALAY
Amarapura
Ava
Pagan
Yaw
Prome
Toungoo
Pegu
Sittang
Shwegyeen
Karennee
Zimme
Lapoora
Rangoon
Martaban
Gulf of Martaban
Amherst
Moulmein
Tavoy
Mergui
Mergui Archipelago
Tenasserim
Elphinstone
King I.
Caboosa
Tavoy I.
Mosces I.
Narcondam I.
Little Coco
Great Coco I.
Preparis South Channel
Preparis North Chan.
Preparis I.
Mouths of the Irawadi
Irawadi R.
Bassein R.
Rangoon R.
Sittang R.
Tenasserim R.
Tavoy R.
Salween R.
Kiang
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Karennee
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Martaban
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Mouths of the Irawadi
Irawadi R.
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SCOTLAND ON SAME SCALE
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SE-CHUEN
Ning-yuen
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Yong-ning
Chao-tung
Lu-tien-ting
Ta-ting
Ma-shang
Hui-li-chow
Wei-ning
Kwei-yan
Kiang chow
Tung-chuan
Sian-wei
Ngan-chuen
Kuang-tung-tzu
Kuang-tung-po
Lung-tai
Yuen-lin
Po-ngan
Tan nan Pass
Yao
Yun-nan
Lu-tsing
Lu-liang
An-ling
Tien-sha
I-liang
Lo-ping
Tsin-ning
Chai-kiang
Sha-chang
Hing-i
Kiang-tong
Kuang-si
Hong-chu
Sin-hua
Ho-si
Nung-chow
Sin-ping
Kwang-nan
Pe-se
Ngen-lo
Yuong-kiang
Lin nan
Talan
Meng-tzu
Pu-erh
Esmok
Sama
Man-hao
Lao-kai
Cao-bang
Lung chan
Tai-ping
Nam-ning
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Pakdong
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Kan-yen
Leong-soi
Nam-dinh
Ninh-binh
Hon Ne I.
Kwang-Suong
Bien-son I.
Tien chow
Hon Mat I.
Nhuong Harbour
Ang Bay
C. Vung Chua
Dong hoi
Kwang binh-dinh
C. Lay
Chumay B.
C. Tien cha
Tourane
Kwang nam
C. Bantam
C. Batangan
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C. Padaran
Tran Ninh
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Tuyen Kwan
Lang son
Thai-ninh
Hung-yen
Nin-binh
Phrabang
Luang
Me Kong
Pak-mon
Pa-kay
Pakben
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Nong-kai
Pon-pissai
Kampoa
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Khassy
Na-kau
Na-le
Nau
Kuy
Thu dua
Met
Pi-eum
Huong R.
Yong-sawi
Kerv-tao
Nongbo
L. Bo
Saniaburi
Sum Kam
La-kong
Wa
Yang
Phitsamlok
Leui
Pechei
Pechit
Poon
Pe-cha-buri
Che-nobot
Bam-muk
Phuon
Falan
Thin
Phong
Song khou
Kwang-tri
Hue
Kemarat
No-kheit
Yasunhun
Saravan
Khamtong-muai
Ubon
Senasay
Chaiapum
Phu Khon Sawan
Ma.No Rome
Pimay
Korat
Saraburi
Ayuthia
Pachim
Prathong
Kanup
Petriu
BANGKOK
Si-su phon
Bang pla-soi
Bang pra
Battam bong
Ban buri
Chentabun
Ra-yong
Koh Chang
Koh Kut
GULF OF SIAM
Sisaket
Surin
Ku-kan
Sankea
Bassac
Pi-muni
Laurie real
Atto pew
Siemlat
Wau
Se un
Nam hu
Mo-kong
Mekong
Yuen R.
Red River
Tam R.
Khon
Clear R.
Song ka or Red River
Hwang ho
Hirate Is.
Nightingale I.
Monitor of the Song-ka or Red River
Gulf of Tonquin
Hon-gay
Ning-po
Kai-nan Strait
Kwang chow
Ung-hoa
Hon-phong
Mao R.
Sai R.
Ke Sung R.
Muc R.
Tuong R.
Song ka
Ha tinh
Nhuong Harbour
Ang Bay
C. Vung Chua
Dong hoi
Kwang binh-dinh
C. Lay
Yang
Kwang-tri
Hue
Chumay B.
C. Tien cha
Tourane
Kwang nam
C. Bantam
C. Batangan
C. Tanguan
Fusanles
Kwinhon
Binh-dinh
C. San-ho
Ko-mung B.
Phuyen
C. Varela
Hon-koe B.
Binh-kang B
Tre I.
Kanh-hoa
Hod-ghi
Kamranh Harb
Binh Tuan
Tuan-dang
C. Padaran
Annam Cordillera
Annam Chain
Kwang-ugai
Kwinhon
Binh-dinh
Phuyen
Ninh-hoa
Kanh-hoa
Binh Tuan
Kwang nam
Tourane
Hue
Chumay B.
C. Tien cha
Kwang-tri
Kwang binh-dinh
C. Lay
Dong hoi
C. Vung Chua
Nhuong Harbour
Ang Bay
Ha tinh
Tsien chow
Hon Mat I.
Bien-son I.
Kwang-Suong
Hon Ne I.
Sai R.
Than-hoa
Tran Ninh
Nin-binh
Nam-dinh
Hung-yen
Hung-hoa
Son tay
Bac ninh
Thai-nguyen
Tuyen Kwan
Lang son
Thai-ninh
Kwi chow
Ninh Kwang
Muc R.
Tuong R.
Song ka
Ke Sung R.
Mao R.
Ung-hoa
Hon-phong
Hon-gay
Ning-po
Kai-nan Strait
Kwang chow
Nightingale I.
Monitor of the Song-ka or Red River
Gulf of Tonquin
Hirate Is.
Gnae chow
Kan-yen
Leong-soi
Hai-nan
Tonquin

that, as in the past, the main arteries of traffic will be by the Yangtze and Canton rivers, to and from the Eastern Sea. Our first duty is to lay down a railway to the China frontier within our own territory. That route will benefit British provinces; it will serve the existing and ancient lines of traffic; it will entail no new political or military risks; it is as likely as Mr. Colquhoun's line to win a big China traffic; and it will bring all the trade to a British port with good anchorage, instead of leaving a part of the trade to be deflected to an inferior port like Bangkok, which now belongs to Siam, and which may hereafter belong to some other power.

As to the capitation tax, Sir Charles said that we found this impost existing under native rule, in Lower Burma, as we have since found it in Upper Burma. It yields £300,000 a year. It has its disadvantages. If the revenue could be spared, he would be glad to see the tax abolished. But if a corresponding addition were made to the land tax, then that burden would at once be raised by 60 per cent.; and as during the last few years we had already raised that tax by 25 per cent., he could not advocate the still further increase that would be involved. The capitation tax took to some extent the place of the salt duty of India, and he believed that it was owing to the lowness of the salt duty in Burma that the great fishery industry was so prosperous and so productive of Government revenue. He should like to see the capitation tax go, because Burma was heavily taxed; but he would not take the responsibility of shifting it to another impost. His conviction was that in cases like the present it was unwise to tamper with the system of taxation with too ready a hand. If relief of taxation could be afforded to Burma, he should rather see that relief come in the form of the abolition of the export duty on rice than in the form of the abolition of the capitation tax.

ACROSS CHINA.

From Bhamô to Shanghai.

Read at Meeting of Society, Edinburgh, 11th January 1888.)

By Henry Soltau.

The first journey undertaken by European travellers from Bhamô in Upper Burma into western China was made by Major Sladen in 1868, when, accompanied by five English officials and a guard of 50 armed police, he penetrated into the province of Yünnan as far as the first walled Chinese city, called Momien, or Tengüeh-cheo. An account of this journey is fully detailed by Dr. Anderson in that interesting book, *From Mandalay to Momien*. At that time the Panthays, or Mohammedan Chinese, were in great strength in the province, and so disturbed was the state of the country that the expedition were unable to pursue their journey further to the East.

The next attempt was in 1874-5, when the British Government lost that able young officer of H.M. Chinese Consular Service, Augustus Raymond Margary. He had been the first to travel alone, from Shanghai to Bhamô, and was treacherously murdered (at Manwyne in the Kang-ai plain) when attempting to conduct a small expedition under Colonel Browne from Bhamô across China.

In 1879-80 my colleague, Mr. J. W. Stevenson of the China Inland Mission, starting from Bhamô penetrated as far as *Yong-ch'ang Fu*, returning in safety; and in the following dry season of 1880-1 he and I determined to make the attempt to cross China from the south-west. Having already resided in Bhamô five years, we had been able to make frequent journeys into the Kachin Hills bordering on China, and had thus made the acquaintance of many of the village chiefs and headmen—had learnt something of their language, treated their sick folk with medicines, and shared their hospitality. All roads into western China from Bhamô must pass through these hills, and hence the importance of being on friendly terms with the wild highlanders inhabiting them.

The most popular route was by ascending the Taping River, a tributary of the Irrawaddy, in boats to *Myo-thit*, and thence over the hills on the west of that river into the Kang-ai plain. The *Ambassador's road* by which the presents were sent from the King of Burma to the Emperor of China once in seven years, strikes off due east from Bhamô, and does not touch the Taping river. There are other routes again that enter Bhamô from the south by Sawadee, striking another part of the Shan district of western Yünnan.

The popularity of one route over another changes from year to year, depending as it does not so much on the ease with which it can be travelled over, as upon the friendliness or otherwise of the hill-men through whose territory it runs.

These Kachins, or Ching-páws, or Singphos, as they are called, inhabit the hills stretching from Assam to the borders of western China. They are gradually pushing more and more to the south, and forcing the Shan-Burmese population to leave the neighbourhood of the hills, and settle nearer the great rivers.

They are a hardy race, wild, good-natured, but treacherous. In every village a number of drinking-opium-smokers are found who are too indolent to work in the fields, and spend their time in making raids on caravans travelling through their neighbourhood, or on the Burmese Shan villagers living in small stockaded hamlets in the plains, at the foot of the hills, watered by the Irrawaddy and its tributaries. These marauders go about in bands of small or large numbers, and are often joined by the other men and women of their villages when there is prospect of any specially good plunder. The boats conveying raw cotton from Bhamô to Tsee-kau for conveyance into China were robbed annually, and sometimes one or two hundred animals, mules, ponies, and bullocks would be in hiding for the purpose of carrying away the booty to the hills.

In the past the Burmese have treated the Kachins as if they were savages, heavily and unjustly taxing all produce brought down to the towns for sale, and not unfrequently shooting down without warning those who have ventured down for the purpose of trade. The Chinese have managed to keep their borders in better order, and are more highly respected than the Burmese by these hill-men.

The men wear a short jacket of cotton cloth with a kilt reaching from the middle of the body to the knee, and folded over on one side. These garments are said to be never changed or washed, but are renewed when they

drop off. A turban of red, white, or blue cloth, ear ornaments, and the "dah" or sword, complete the costume. The women have a similar kilt and jacket, but the latter is ornamented with strips of scarlet flannel, silver buckles, beads and cowrie shells. Round the waist is worn a belt of cowrie shells and a coil of fine rattan-hoops, simply for ornament. The ears are bored both in the lobe and the cartilage, for silver and silk ornaments. Hoops of silver encircle the neck. Both men and women also wear coils of very fine rattan round the leg below the knee.

The chiefs and their sons have an ochre necklace, to show their rank. The hair of the men is twisted into a knot, and worn at the side of the head. Married women wear blue cloth turbans also falling over to one side. Unmarried girls have a fringe, and do not wear any turban, but keep the hair short. All chew betel, and have very black teeth in consequence.

They have no written language, are not worshippers of idols, but make offerings to the "nats" or spirits, by whom they suppose they are surrounded. Their houses are substantially built of wood and bamboo, in sheltered nooks among the hills. The villages are approached by narrow pathways, well protected from invaders by overhanging rocks and dense jungle. When an attack is expected, or when the Kachins have made a raid, and are fleeing with their booty, they line the narrow jungle path on either side with sharp bamboo skewers, in such a way that any one pursuing them will very soon be helplessly maimed by these piercing his bare feet. I once pulled out one that had entered my pony's foot about two inches, just above the hoof.

Though holding a large tract of territory, they are not a strong people owing to their continual jealousies and strifes, and the variety of tribes and dialects among them. There are many blood-feuds between different villages, and often one village will have no dealings with its neighbour for generations, the result of which has been that after a long time they cease to be able to hold communication with each other—the dialects have so changed. The customs and traditions nevertheless are identical.

The women are very industrious, short in stature, but strong, and cheerful. They rise early, prepare the rice for the day, cook the breakfast, and then sally forth to the terraced paddy fields, or to the hillside clearing, to attend to the cultivation of the rice, cotton, and potatoes. Buffaloes are kept for the purposes of cultivation, and a few ponies and bullocks as beasts of burden.

When these hill-tribes find a just and generous rule established in Upper Burma, they will, I believe, gradually become friendly and reliable neighbours.

During the dry season, that is from November to May, caravans of from 200 to 2000 animals, come from China to Bhamô bringing orpiment, copper, iron cooking pans, dried fruits, chestnuts, etc., and taking back bales of raw cotton, piece goods, and British salt, together with salt fish from Burma, and small quantities of matches, kerosine oil, jade stone, and amber. These caravans pay a heavy black-mail to the Kachins, and are usually escorted by a large body of them for purposes of protection. Finding that a caravan of some 600 animals was returning into

Yünnan, we made arrangements to join it, and started from Bhamô on the 29th November 1880. Two friendly Kachins were specially engaged to look after us during our forty miles through the hills. Our party consisted of Mr. Stevenson, myself, and two Chinese servants, one to cook, the other to attend to our four ponies. One pony was laden with bedding, clothing, and cooking utensils; another with medicines and Chinese tracts and Testaments for distribution in China. The other two were saddled.

Over forty Kachin chiefs, representing as many villages, for the most part mounted on diminutive ponies, were responsible for the safe conduct of the caravan through the hills. They had about 150 men with them armed with spears and *dahs*. The muleteers were mostly Shans and Chinese, and numbered about 150 or more, and these, with a few Chinese merchants travelling with their goods, made up the party. We rode at the very end of the procession, which daily took two hours getting under weigh from the starting off of the leader until our turn came to follow. Our average journey was about ten miles a day, and occupied us from about 6 A.M. until 3 or 4 P.M.

After leaving the plain of the Irrawaddy and Taping rivers, we crossed several small rivers falling into the Taping, and then followed the left bank of that river, winding in and out among the gorges through which it rushes, ascending and descending narrow bridle-paths which skirt or cross the hills through charming forests, or over huge boulders in the river beds.

At the end of the day the loads were placed close together in a solid square, outside which the animals stood, tethered by one foot to pegs driven into the ground. Branches of trees or grass were used for making booths for the men on the outskirts. The Kachins kept up large camp-fires, and set watches all night, to protect from tigers and robbers. Nothing of importance happened until noon of Wednesday, December 1st, when a halt having been called for lunch, Mr. Stevenson and I were attacked by a small band of Kachins of another tribe from that with whom we were travelling, and whose territory we were about to enter. They endeavoured to take our ponies and goods from us, and to get us into their power; but the Kachins and Chinese travelling with us interfered, and after a severe fight with their *dahs*, in which no blood was drawn, we were released from our assailants, and sent to a place of safety. The robbers and our friends had a protracted conference, interspersed with much opium-smoking, drinking, gun-firing, and altercation; during which a demand was first made for our lives, then for a hundred rupees, for fifty rupees, and at length a settlement was effected by which we were to pay twelve rupees (£1), and to be allowed in the future to come and go unmolested through that territory. The cause of it all was that the chief of that village had come down to Bhamô at Major Sladen's invitation in 1867, and had there lost his life in a mysterious manner. We were the first Europeans to travel along that route, and according to Kachin custom our lives were forfeited in exchange for the life of the chief, for whom they professed to hold Major Sladen responsible. We ascertained subsequently that full satisfaction had been given to them

at that time. During the evening they all drank the "loving cup" together, became very excited, and fired off their loaded muskets in all directions. The next day at sunrise we left without any further trouble, and I should now have no fear in going into that village again.

On the eve of the last day of our journey through the hills, the fifth day after leaving Bhamô, the caravan was again stopped by Kachins, who demanded additional blackmail from the Chinese merchants, and would not let them proceed until they had paid them Rs. 80 and forty ounces of opium.

Around the camp-fires at night we had long talks in our little huts, and confirmed the stories that had been told us by Kachins from other districts respecting their traditions.

They believe that once they had a book written upon a skin, but that a famine occurring their ancestors boiled the book and ate it, since which time they have had no writings among them, but have all their learning inside them. This is specially stored up in their *Doom-sahs*, or priests.

Being asked why they were such a poor race, whilst the Burmese on one side and the Chinese on the other have plenty of wealth, they said that formerly, ages ago, there were only four brothers, the Chinaman, Shan, Kachin, and Burman. The Great Spirit told them to come before him that he might give them what they would need. They came, the Chinaman bringing a bag, and the Kachin an open basket of large wicker-work, such as those which they carry on their backs.

The Spirit was giving out silver, and the Chinaman went off with his bag full of silver, his Kachin brother getting his basket filled likewise. As the latter proceeded over the hills the nuggets of silver dropped out of the open basket, and by the time he arrived at his home he had scarcely any left, whereas the Chinaman reached home a wealthy man.

Some time after this the brothers were again summoned before the Spirit, when the Kachin brought a bag. The Chinaman, however, brought an open basket. "Nats" or spirits were served out, and the Kachin went off with his bag full of devils, which have remained in his house and country ever since, whilst those the Chinaman was carrying escaped out of the open basket; hence in China spirits are few, whereas on its hills they are exceedingly numerous. The Kachins have no medicines among them, though tradition says that once they had roots, barks, and herbs, which they used. These, however, being put out to dry on a mat, were eaten up by a buffalo, a pig, and a fowl. Hence all medicines are now inside these creatures, and if any one is sick and the illness very serious, they sacrifice a buffalo, because it ate the most medicine; if it is slight, a chicken is killed, and part of it offered to the "Nat" who has brought the illness. These "Nats" often are believed to take possession of the people, and must be exorcised by the *doom-sahs*.

We were not sorry to leave the hills and descend into the peaceful and prosperous plain of *Kang-ai*, or *Muang-la*, about forty miles long, by two to five miles wide. Through the centre flows the Taping River, receiving on its way numerous streamlets from the hills that shut in the plain on either side. These streams are utilised by the industrious Shans

for irrigating their rice-fields, which are made in terraces stretching down to the river.

Villages are dotted all over the plain, hidden by the clumps of feathery bamboo and hedges of cactus. Harvesting was in full operation as we entered the village of *K'in-ying*, the headman of which came out to meet us, and gave us a warm welcome to his house. The Shans are more numerous, more civilised, and extend further into China and Burma than do the Kachins. They are an ancient people, and are called by the Chinese *Pai-i* or *Peh-i*.

In Western China the dress of the men consists of a jacket usually of blue or white cotton, with wide trousers of the same reaching to the knee, or some distance below it. The legs are swathed to the ankles with bandages of blue cloth. Shoes are worn as in China. The turbans of the men are often of great size, but those of the women are most striking, being like an inverted cone composed of many yards of cloth folded crescentically around the head. The women's dress is a jacket of light or dark cotton or silk, a skirt usually of dark material ornamented with elaborate patchwork of bright silks worked with gold or silver thread. They wear silver ornaments in their hair, ears, and on their jackets. Their complexion is lighter than that of the Burmese, and the eyes are rounder and less lozenge-shaped than the Chinese.

The houses are of bamboo, the floors not raised from the ground, but made of mud beaten hard. Opposite the door a circular portion of the floor is raised for a fireplace, around which the friends gather of an evening for a chat, the fire being fed by handfuls of straw, the only fuel which they have here, as all the hills are perfectly bare of wood.

We found the people exceedingly friendly, and very anxious that we should remain some time with them. Following the left bank of the Taping we ascended the plain, passing through paddy fields and villages, where all the men and women were busy reaping and gathering in the harvest, the buffaloes leisurely treading out the corn. The plain is shut in at either end by the closing in of the hills. Crossing these we found Kachins again in power, and toll demanded by them. This occurred more than once when crossing hills from one plain to another even in Chinese territory.

We had by this time left the greater part of the caravan, and had bidden adieu to the drunken Kachin chiefs at Kiu-ch'eng, the last town in the Kang-ai plain.

At this town we were able to procure a supply of Chinese silver, in nuggets, upon an order given us by a Chinese merchant in Bhamô in exchange for a cheque on Rangoon for Rs. 750. We also carried about a hundred rupees each in belts, which were gladly received by traders as far as Ta-li-Fu. In every place we were able to sell the silver for Chinese cash, at the rate of from 1200 to 1900 cash for the ounce of silver. The ounce however varied in weight, and became lighter the further east we travelled until we reached Yünnan-Fu.

Another plain occupied by Shans and Chinese was crossed, and then we began the ascent of the hills leading to *Teng-üeh-Cheo*, which city we reached on the 11th December, twelve days after leaving Bhamô.

The road was good, though steep, and as we neared the city we saw the hundreds of graves which always mark out the neighbourhood of a Chinese city.

The city is situated in a large plain surrounded by mountains and hills, the sides of which are dotted with small towns and villages ; some of these contain more houses than the city itself. Everywhere we saw traces of the devastating Panthay rebellion. The interior of the city is mostly ruin, and the chief business-houses are outside the walls, with shops containing all kinds of merchandise—cloth, harness, meat, coffins, shoes, hats, and clothing. Tea-shops and inns are here also ; into one of the latter we went, and were shown into a little room seven feet square, in which we could scarcely stand upright, and the walls of which were reeking with the smell of opium. A small window looked out upon an open drain in which two or three miserable pigs were wallowing.

We were glad of this shelter, however, from the piercing wind, which seemed to cut us through after the tropical heat of Bhamô. A few Burmans whom we met in the city looked the picture of misery in their thin silks, red blankets, and faces tied up.

We remained here two days, and had some interesting conversation with some military officers, who inquired if we knew General Gordon, under whom one of them had served, and evidently held in great admiration.

Yünnan is an exceedingly mountainous province, and the trade road between the capital and *Teng-üeh-Cheo* we found traversed great elevations, and was often in such a condition of ill-repair we marvelled that any trade could be conducted over it.

The road has once upon a time been paved with great slabs of rock. These in process of time have become loosened in many places, and taken away for hedges, and for buildings in other parts, so that the animals often had to make a succession of leaps from one boulder to another, or run the chance of sinking to the belly in mire.

You always commence your day's travel with a steep ascent, and after toiling up and down the zig-zag paths by steep precipices, and across streams and rivers, you end the day by a descent into a valley where will be a village, town, or city, with the long-looked-for and often comfortless inn.

For some distance from Tengüeh the road is well paved until a long ascent has to be made, to the height of about 7500 feet above the sea. Opium, beans, and tobacco were the chief products of cultivation that we passed in the terraced fields—all was bare on the summit of the hills. A steep descent brought us to the valley of the *Long-Kiang* or *Shwé-li* river, which empties itself into the Irrawaddy a little south of Bhamô. It is spanned by a suspension bridge of iron chains hung from two piers of masonry. Eight or nine large chains are laid side by side, and planks of wood are laid across them. Two animals only were allowed on the bridge at one time, on account of the great oscillation produced when they trotted across. The river here is of considerable depth, and was perfectly clear.

Another steep climb brought us to the pass dividing the Long-Kiang

and Lu-Kiang valleys. The famous and lamented traveller, Captain Gill, in his book, *The River of Golden Sand*, gives the height of the summit as 8129 feet above sea-level. A superb view is here obtained of the valleys of the two rivers—the *Shwé-Li* on its way to Upper Burma, and the *Salween* or *Lu-Kiang* to the Bay of Bengal. In the distance could be seen the snow-capped summits overlooking *Ta-li-Fu*, and to the north the spurs running south from the Himalayas. Pine-forests cover the hills on all sides, reminding one of home scenes.

The valley of the Salween is very much dreaded by the Chinese on account of its miasma, and they will not cross it except at a certain time of the day for fear of being attacked by the severe fever that lurks here. To our surprise we found the valley under cultivation, and dotted with Shan villages, whose inhabitants reside there all the year round. The rainy season is said to be the unhealthy time for this district. The descent to the river was long and tedious, and the road dangerous. A fine suspension bridge, 120 feet in length, spans the deep blue river. It is built in two sections supported by piers of masonry on either bank, and united on an island in the stream by a huge pier sufficiently wide to admit of the two sections of the bridge being laid side by side; so that on reaching this pier you turn sharp to the left, and enter the archway of the second portion. The links of the chains are from 6″ to 9″ long, and about $\frac{3}{4}$ inch thick. A similar bridge spans the Lan-Kiang, or *Cambodia* river, which we crossed three days later. The Chinese are justly proud of these iron structures, which they say they cannot build now.

In addition to the fevers which prevail in this valley, the plague has been raging here and round Yong-Ch'ang-Fu ever since the recent Mohammedan rebellion. We were told that at that time there was a great slaughter of men and animals, and their bodies were long left unburied. After some time the plague broke out, and has never left the district; rats, dogs, cows, and horses, all suffer from it. All over the hills the people suffer much from goître.

The next place of importance we reached was *P'u-p'iao*, in the neighbourhood of which are famous hot sulphur springs, which we visited with the intention of taking a warm bath. We found two large baths, one for men and another for women, with suitable approaches, surrounded by stone walls. The water was very hot, and we could not bear our hands in it at first. We were deterred from bathing by the miserable specimens of diseased humanity that we found in the bath, and also by the advent of a buffalo and her calf, which took a long bathe with great relish. A great many sick people come to this place for the sake of the waters.

The important city of *Yong-Ch'ang-Fu* was reached December 17th. It is somewhat famous for its large reservoir outside its walls, which supplies the farmers in the valley below with water. The road to the city passes along one of the embankments.

The city was full of students up for their examinations, and we experienced some difficulty in getting an inn. The people were very curious to see us, and the paper windows were riddled with finger-holes by the men, women, and children outside, each hole being filled with a black eye gazing upon us. They were not satisfied until I went to the

door, explained all my articles of clothing, and showed myself before and behind. A Chinese crowd is not difficult to manage if you can raise a laugh among them. Extensive ruins inside the walls of the city, and the absence of temples and idols, remind one of the destruction wrought by the Mohammedans. Temples are being rebuilt, but most of the business-houses are still outside the walls, as some of the merchants told us that it was far safer for them there, seeing they could run away if they were outside, but must starve or be killed if within, should another rebellion occur.

Between *Yong-Ch'ang-Fu* and *Ta-li-Fu* the road was worse than any we had passed, and yet caravans are continually travelling over it. We did not attempt to ride down the hills; it was as much as we could do to keep our footing. The gorge through which the Lan-Kiang, or Cambodia river, flows is almost precipitous, and the river cannot be seen until you are close upon it. The descent is about 3000 feet, and the ascent on the opposite side over 2000 feet to a table-land, where wheat, opium, and beans were growing. The mountains increased in height as we neared *Ta-li-Fu*, and the scenery became wilder. The population between the large towns is very sparse, and acres upon acres of waste lands are passed which once were fruitful paddy fields. In many of the small towns and villages we found Mohammedans, who were more friendly than the ordinary Chinese. Their physiognomy is somewhat different, as they are taller, and lighter-complexioned, and with a more aquiline nose.

The most beautifully-situated city we saw was *Ta-li-Fu*, which lies a little off the main road, on the *Erh-Hai* Lake. It is sheltered by a range of mountains which are snow-capped almost all the year round. During the hot season snow is sold in the streets for cooling the water. *Ta-li* is a large and important city, with a strong wall around it. Close by, on the borders of the lake, are villages of *Min-kia*, a timid, short-stature race of aboriginal tribes. They get their living by fishing, boating, and agriculture. The lake is about 30 miles long, and from 5 to 10 miles broad at its widest parts, and is distant from the city about 4 miles. The people took very little notice of us here, they are so accustomed to seeing other barbarians that our peculiarities were not noticed. We remained here a week, saw the Roman Catholic missionaries, and visited a great many sick people among the upper and lower classes. The mountains to the west of the city produce the famous landscape marbles, which are seen in the houses of the wealthy Chinese, made into tables, or into the backs and seats of chairs. The slabs are of grey, or white streaked with dark green, brown, or yellow-grey, and look like sketches of distant landscape scenery, with trees, hills, and water. In the village of *San-ta-sze*, or the *Three Pagoda Temple*, we found most of the people occupied in cutting and polishing these beautiful stones. Granite also is plentiful, and well worked.

In the plain surrounding the lake there is extensive cultivation. In the wet season paddy is grown, and after it has been reaped the fields are irrigated for some days, and then the water is turned off, and beans are dibbled in, without any ploughing or working of the land. If opium is to be sown, the fields are ploughed and well worked before the sowing is done.

In all the villages surrounding Ta-li the majority of the houses were in ruins. The Mohammedans suffered much here. One temple was shown us near the lake in which one of the imperial generals is said to have sat to receive the arms and submission of the Mohammedans, who could hold out no longer. We were told that having received their arms, he bade his soldiers drive them all into the lake—men, women, and children, and all were either butchered or drowned.

Ta-li-Fu has never recovered from the effects of the rebellion. Large portions of the city are overgrown with grass. Shops and warehouses are few in number, and contain a very small assortment of goods. The business centre for the district is at *Hsia-Kuan*, on the main road between Yong-ch'ang and Yünnan-Fu. Caravans start from this for several important parts—some to Mandalay, Yünnan, Bhamô, or Tibet; the latter passing through Ta-li-Fu.

Our first day's journey along a level plain, after leaving the Kang-ai plain, was on the day of our leaving *Ta-li-Fu*, as we again turned our faces eastwards. For many miles we passed through a well-cultivated country, the terraces extending some distance up the hills on either side, nestling among which were prosperous villages. As the hills converge cultivation disappears, and we enter pine-forests and jungle scrub. A pass through these led us again into an extensive plain, well cultivated, and dotted with thriving villages. We met for the first time flocks of sheep and goats, which were very numerous as we proceeded further east.

Hong-ai, or *Redcliff* town, is situated in a very extensive plain, the soil, as the name denotes, being red, with beans, opium, wheat, Indian corn, and paddy growing luxuriantly. Mills of rude construction are worked by water, and used for pounding the oil-seeds, beans, and wheat. Everywhere we noted the great scarcity of population, and the vast stretches of cultivable land with no one to till it. Turnips are much grown on some of the hill-sides. The roots are taken up when full-grown, sliced, dried, packed in bundles, and sent to market.

As we travelled from town to town the accommodation in the inns varied. In many places the provision for ponies was much better than that for their owners. The houses are usually built of sun-dried bricks, with mud floors—a fire place often in the centre of the room, which lets all the smoke circulate freely inside. Beds of wood, with filthy straw mattresses, a greasy table, never washed, and a rickety chair or two, completed the furniture.

We always pitched the mattress out of the place, spread a towel, which we carried for the purpose, over the table, bought a bundle of straw for bedding, and let our ponies eat it up the last morning before we left.

For the small sum of sixpence a head we usually obtained as much rice as we could eat in the evening and morning, and the lodging for a night, together with the use of the kitchen fire. Meat and vegetables were extra, but not expensive. Chinese pork we always avoided, if possible, and lived mostly on eggs, vegetables, beef, or fowls, and mutton, where these could be obtained. Bean-curd (Teo-fu) is very sustaining, and with rice and some greens makes a good meal. We never carried

knives and forks, preferring the very convenient chop-sticks and little basins.

Having a good supply of European candles we were independent of the filthy oil-lamps which every landlord supplies, and which consist usually of a saucer of stinking oil with a wick floating in it. This lamp and the Chinese mode of eating account for the greasy condition of the tables in all the inns. We usually had the company of rats at night, which sometimes scampered over our beds, or attacked our baskets of books and clothes. When they were more numerous than usual we kept the light in all night.

Between Ta-li-Fu and Yünnan the traveller passes through large tracts of barren country. Very little rain falls in these places, and the few inhabitants look wretchedly poor and ill-fed, and many die of starvation.

Coal becomes plentiful after passing *Yünnan-i*, and is made into cakes with clay, and sold in the markets. In many of the inns it was used, making a dull cheerless fire. Further on pine-forests were passed, and animals laden with planks of fir strapped on to their sides were not pleasant to pass on a narrow road. Pheasants of beautiful plumage, and very tame, ran across the road, and could easily have been shot, but we carried no fire-arms of any kind, so the birds were left in peace.

The *Lo-los* inhabit the hills around these parts. We saw a few of them; they are like Kachins in their physiognomy and character. Like them they carry their loads on their backs in baskets with a yoke attached to the neck. The men dress like Chinese in jackets and trousers of coarse cotton cloth. The women wear a curious oblong piece of cloth with a hole in the middle, through which the head passes, the sides being open, and the front and back well covered. Below this they are dressed in a similar manner to the men. Their ear ornaments are hoops of silver about three inches in diameter. We saw none of their houses, which were hidden away among the hills. The Chinese have small guard-houses along the road, mere huts, where a small tax is exacted from travellers in return for keeping the road secure from the Lo-los.

Some years since these people came down suddenly on the towns of *Yünnan-i* and *Hong-ai*, killed every man and animal they met, and carried off all the goods they could find, and a large number of women and children as prisoners. The Chinese sent a force against them which killed several of the villagers, but not as many as they had themselves slain of the Chinese. Peace has since been restored. The *Lo-los* are great cattle-breeders, and sell to the Chinese horses, cattle, and sheep. They also bring down large quantities of firewood and vegetables for sale. Formerly they were governed by a king, but now they are under headmen chosen by themselves in each village, and pay a small tax to the Chinese.

Not far from *Yünnan-Fu* outside a village were two cages hanging on trees, each containing the head of a highway robber, who had been recently executed for robbery along the high road. A gang of twenty were captured. These two were executed first as a warning, and the

eighteen were being kept in jail until they disclosed where the silver was, when they will probably meet with the same fate. They stole about £500 worth of silver.

All the travellers we met carried guns, swords, or spears, and if they were conveying valuables were escorted by soldiers from guard-house to guard-house.

We were for some time in the rear of a caravan of mules carrying several thousand taels of Government silver, being the duty on salt, which is manufactured in large quantities near this part. Salt is a Government monopoly in China, and none of that which is brought to Bhamô from Rangoon enters Chinese territory. The large salt-wells in Yünnan give employment to many people. The brine is boiled in iron pans, and then evaporated, leaving conical cakes of salt of such a size that half a cake is as much as one man can carry.

At *Lu-feng-Hsien* we crossed a substantial stone bridge of seven large arches, the roadway paved with flags of considerable size, and soon after came to a busy little place called *Yao-Chang*, or blacksmith village, where we laid in a good stock of nails and shoes for our ponies. It is the custom in these parts to carry all the implements needed for shoeing your animals, and to replace a shoe whenever it falls off. Here we met the first tea caravan from Pu-erh, passing on to Yünnan-Fu ; also hundreds of mules, ponies, and bullocks, going to the salt-wells for salt. The country immediately round the capital of the province is miserable in the extreme. To the south of the city is the lake, situated in an extensive plain partly under cultivation. Bluff promontories from the hills jut out into this plain and lake. A badly-paved road leads round to the city, crossing canals, swamps, and paddy fields. The busy part of the city is on the south side, where there is an extensive suburb containing large business-houses and many dwelling-houses. Crowds of people filled the streets. The idol-makers, incense and flag sellers, were busy selling ornaments and scrolls for the New Year's decorations. We hurried away from the capital to avoid the long detention that would be involved in passing the New Year here. The first wheeled carts since leaving Bhamô were met with as we left Yünnan-Fu for the north—one bullock in each cart drawing charcoal, vegetables, fruit, salt, or timber. We passed several hundreds of them during the next two days. The hills between the capital and the borders of Szechuen are full of minerals—coal, iron, and copper, red white and blue. The province generally is full of minerals, gold and silver being abundant in some parts ; iron and copper very general.

Caravans of nimble ponies laden with cotton cloth from Szechuen, and raw cotton from Hu-peh, were continually met with. The Burmese cotton does not come further than Yünnan-Fu. Crossing a vast undulating plateau of considerable height above the sea, we found the people very poor, subsisting on rye, potatoes, millet, and a small bean. It is too cold for rice. No goître was seen here, though it was frequently met with on the Kachin Hills and across the province to this part.

The *Tsai-tsze* is much grown at this elevation, and yields a seed from which an oil is pressed which has a most offensive smell, like putrid

flesh. It is used for cooking and lighting purposes. We now had to travel through snow, over dangerous mountain passes, and in the face of a biting north-east wind. We followed a long tea caravan, which marked out the path for us. The men in charge displayed great skill in preventing the ponies from stepping over the edge of the dangerous precipices along which the narrow path skirted. Shepherds arrayed in coarse woollen blankets made of a kind of felt dotted the hill-sides, watching their sheep and goats.

Tong Ch'uan Fu was reached on the 29th January 1881. Here we spent Chinese New Year's Day, it being considered very unlucky to travel on that day or the next. A Mandarin in the next room to us had the cook of the inn put into prison because his breakfast was late and badly cooked, and the water not hot enough for his morning ablutions: this proved inconvenient to us for some time ; happily the irate official soon left, and the cook returned to his large iron stew-pan with a smiling face. Passing on through several small villages, one of which, *Hong-Shih-ai*, is famous for its trade with *Huei-li-Cheo*, a busy town in Szechuen, which is in the centre of a copper-mining district, our road lay through narrow gorges, up steep ascents, following in the track of a caravan laden with opium, copper, and sulphur, to a plateau where were a few scattered houses and a small town called *So-K'iao-Sin*. This place is remarkable for its climate ; half the year it rains and the other half it blows a gale of wind, and there is sunshine. The people do not like to talk about the wind for fear it should blow, and in conversation they never use the word "feng," which means wind. Further on we passed groves of the beautiful Ch'ong-erh trees covered with bunches of black berries and leaves like the apricot. These trees furnish food for the white wax insect, the chrysalis of which is tied with wisps of straw to the branches of the trees. The moths lay their eggs on the twigs, and the grubs feed on the leaves, and secrete a wax which is made into candles or ointments. Some trees yield one or two pounds, others only a few ounces. In the valleys the heat was very great ; whereas, on the hills, we found it still very cold. From the river Fah-nah, with the town of the same name on its bank, we ascended a steep hill for three hours, on the summit of which were numerous holes whence coal was extracted. Wild fowl were here very abundant.

Chao-T'ong-Fu—a very busy place—was reached on February 4. The cold was intense during the next few days of travel—the hamlets inhabited by miserably poor people, who seemed to subsist on maize and millet and oatmeal. We met two *Miao-tsze*, the man with long locks of hair hanging loosely over his shoulders, and wearing a curiously coloured coat and white trousers. His wife was leading a goat, and was arrayed in a long jacket-gown of flaxen cloth, her hair elaborately dressed in the shape of a cone or pagoda on the top of her head. Shortly after we met 216 animals laden with cotton cloth and black salt. The further we went the worse the roads became. It was with difficulty our pack ponies could keep on the narrow ledges, and when we met a caravan there was imminent danger of pony and pack being rolled down the steep precipices, 300 or 400 feet, and killed. Several animals have met with this

fate, as may be seen by the bones lying in the valley below. At length we had to hire men to carry the loads, and let the ponies go free. The porters who undertake this work will take three bales of cotton, piled one above the other, far above their heads. These loads are firmly strapped to their backs, and cannot be removed by the bearer. A T-shaped stick is placed under the load when the man desires to rest, which he does every few steps, always giving a whistle as he plants himself against the stick. The loads weigh from 150 to 200 lbs., and the average journey made is 4 miles a day. All goods are conveyed in this way except some of the tea, which, I understand, is carried in very small loads on ponies. There are tea-houses, refreshment stalls, and inns all along the road.

On the 7th February we reached the last city in Yünnan, *Ta-Kuan-Cheng*, a busy little place on the top of a hill. There were fewer ruins here than in any of the cities we had passed. Beyond this the roads became still worse, and the scenery grander and grander. Near *Ta-Uan-tze* the climate was mild—the sun very powerful by day—orange and walnut trees in much profusion; the latter we had not noticed since leaving the neighbourhood of Ta-li-Fu. Each day we passed some towns and villages, the population being more numerous than in other parts of the province.

At length we reached the end of our road journey, *Lao-wa-t'an*, a busy town on the Hen River. We dismissed our two Bhamô servants, sold our horses, and after two days' journey on foot past the worst rapids, took a small boat. Four men carried all our loads, and a Sze-Chuan man acted as cook.

At *T'án-t'eo*—the head of the rapids—we embarked on the 14th February, having been seventy-seven days since leaving Bhamô. The crew consisted of two men to row and one to steer. We descended several rapids, making 21 miles in 3 hours and a quarter. At *Sin-t'an* we changed boats for another place called *Mo-tao-ki*.

We were now fairly in the province of *Szechuen*—all traces of the rebellion were gone, and prosperity and comfort were manifest on all sides.

At *Mo-tao-ki* another change was made, and owing to the dangerous state of the river, we had to walk to *Chang-ô*, where we embarked in a large boat for *Sui-Fu*. The boat was about 100 feet in length, flat-bottomed, with square bow and stern. Two-thirds was covered with a roofing of matting, over which was a small bridge on which the helmsman sat. In the bow was fixed a sweep-oar, which projected about 10 feet into the water. Six men and a pilot worked this when we descended a rapid, while 12 others standing behind them laboured at the oars, standing up and facing the bow. As they rowed they sang *Ya-a-ha* as a chorus to a chant led by one of their number. The rapids were frequent and dangerous. All depended on the skill with which the pilot managed to bring the boat round when shooting them. Before approaching the dangerous spot the rowers worked with all their might until the boat had a good way on her, and at a given signal they pulled in their oars, as the channel often lay close to a wall of rock; the pilot and his men let down their sweep, and seconding the effort of the helmsman directed the unwieldy craft through the boiling waters among the dangerous rocks. At length we

glided into the river Yang-tsze, by the little town of Gan-pien. For some time the clear water of the Hen flowed side by side with those of the turbid Yang-tsze, but at length they mingled, and we quietly made our way on its bosom to *Sui-Cheo-Fu*. Numbers of large boats were being towed up the river by from 5 to 50 men, according to their size.

Sui-Fu is an important city, and different from all we had hitherto passed. Here we took another smaller boat for *Chong-king* and overtook many bamboo rafts laden with cotton. The hills on either side were cultivated to their summits ; even the ledges of rock had been covered with earth, and small patches of vegetation were seen upon them. The population everywhere was dense. The farmers' cottages dotted the hills in all directions, and the people were well clothed and comfortable. We did not stop at any of the large cities on the way, save to buy food. We had some delay by fog, but at length reached *Chong-king* on the 22d February.

Chong-king, the Liverpool of western China, is an irregularly built city, situated on the left bank of the *Yang-tsze*, and partly on four hills, and the rest on a plain. The streets are narrow and crowded with people, who seemed prosperous and wealthy.

Here we found the first Protestant mission-station, opened some time before by the China Inland Mission, and much enjoyed hearing our own language spoken, and meeting our fellow-countrymen after travelling nearly three months. We remained here 10 days, leaving for *I-ch'ang* by boat March 1st. Hundreds of boats and junks lined the banks of the river, near the city, and as we proceeded we met many more of all sizes being tracked up by strings of men with long ropes of plaited bamboo.

Flourishing cities, towns, and villages were passed from day to day, save when the river wound through narrow gorges among the mountains. Cultivation was carried down to the water's edge, and up to the top of the hills. Near the towns men were plying small boats laden with vegetables and delicious oranges, and trading with the boats passing up and down.

At a large city, *Wan Hsien*, we received a pressing invitation from the chief Mandarin to breakfast with him. We declined the honour on the plea that we had no suitable clothes to appear in. He would take no refusal, and sent chairs for us. He had been a great friend of Mr. Mesny, for many years a resident in China, and was anxious to see Englishmen. In the course of conversation we touched on the subject of medicine and doctors ; and he asked if we knew a famous Dr. Holloway, whose pills and ointment he much esteemed. The breakfast being served we were first given some hot spirit, of which we did not partake. Ham cooked with sugar, mutton, fowl and pork cooked in various ways, were placed on the table in small basins, into which we all dived with our chopsticks after our host had taken a morsel himself. At the close, plain boiled rice was served, and after a cup of tea we took our leave, having spent a very pleasant morning with this intelligent and open-hearted man.

Immediately below this city the navigation of the river became very difficult, and often dangerous, owing to the frequent rapids which have to be shot. Between the rapids are magnificent gorges, formed by precipices of rocks on either side, which were tipped with snow.

We noticed in Szechuen province the great prevalence of cloudy skies, and for days together we did not see the sun. This may account for the fact that the province south of it is called *Yünnan*, which may mean *south of the clouds*. The cold was intense all the way, and the rapids often very exciting and dangerous.

We reached I-ch'ang on the 14th March, and spent two days with the missionaries of the Church of Scotland residing there. It is the terminus of the steam-boats from Shanghai, and was situated immediately below the last of the gorges on the river. We, however, continued our journey by small boats, and reached Wu-ch'ang-Fu on the 25th March.

The journey from Chong-king to Shanghaö has so frequently been made, and so ably described, that I forbear to trespass further on your time.

When I accepted the invitation to submit to your Society these notes of our journey, I had not discovered that the dacoits in Upper Burma had retained two important note-books of mine, which contained full particulars of our journey with regard to the number of miles travelled, the heights of the hills crossed, and the expenses incurred. This will account in some measure for the lack of that geographical information which should have been found in this paper.

PULO CONDORE.

THE following paper has been copied from one in the Record Department of the INDIA OFFICE (O.C. 8188), among a selection of such records which will shortly be issued by the Hakluyt Society, in illustration of the Diary of Sir William Hedges (1681 *seqq.*), which that Society has recently printed.

The island of Pulo Condore[1] was selected as the site of a factory, in the first year of the eighteenth century, by the New E. I. Company, or ENGLISH Company, as it styled itself, in distinction from the Old or LONDON Company. The former Company had made various unsuccessful efforts to establish the direct trade with China on a satisfactory footing, under the presidency of Mr. Allen Catchpoole, the author of this report; and in 1700 he had recommended an experimental settlement upon Pulo Condore. This the Court of the Company sanctioned a year later, after consultation with the famous William Dampier, and Mr. Rashell or Rashwell was sent out to act as Governor till Catchpoole himself, then at Chusan, could take charge.

Catchpoole's idea seems to have been much the same as that which led to the temporary occupation of Chusan, and the permanent occupation of Hong-Kong, in our own age. He thought it might make a *point d'appui* and *entrepôt* for trade with the Chinese ports, whilst keeping clear of Chinese caprice in interference with the trade and factory. He seems

[1] Situated in South China Sea, south of Cochin China.—ED.

also to have had some unwise notion of making it a base for reprisals on Chinese shipping for high-handed acts by the Chinese authorities, which might still occur.

The scheme came to a disastrous and tragical end. On the night of the 2d-3d March 1705, the Macassar soldiers, employed as garrison, set fire to the buildings and murdered fifteen or sixteen of the English, including President Catchpoole himself. On the 10th of the same month the Cochin-Chinese on the island murdered all the Europeans who remained upon it, except Mr. James Cunninghame, one of the factors, who was severely wounded. Mr. Baldwyn the chaplain, and a Mr. Wingate, had been sent off for help the day after the first massacre, whilst one or two others, apparently, had escaped about the same time;[1] but that was all.

Allen Catchpoole went out to Bengal as a writer in 1673. He did not get on well with Job Charnock, whose part the Court in Leadenhall Street always took strongly, and in 1683 they dismissed him. He afterwards was a comrade in "interloping" adventures with the famous T. Pitt; and when the New Company was established in 1698, like many other dismissed servants of the Old Company, he took service under them, and was commissioned as President of their intended factories in China.

It may be remembered that the Condore group is mentioned in the Arab *Relations* of the ninth century, translated by Renaudot, and again by Reinaud, under the name of Sundar Fúlát (where the latter word appears to be an Arabicised plural of the Malay *Pulo*); and also cursorily by Marco Polo, under that of *Sondur and Condur*. Dampier stopped there to careen, in 1687, and spent a month on the group, of which he gives an account marked by his usual intelligence.

The islands had another visitor of similar high intelligence and more cultivation, in the person of the late John Crawfurd, when on his mission to Cochin-China in 1822. He mentions finding traces of the unhappy English factory, and some faint tradition of it surviving among the natives.

About the year 1720 some attempt to found a settlement there was made by the French, who gave the chief island the name of Isle d'Orleans. The celebrated P. Gaubil spent eight months on the island, and wrote an interesting letter about it (dated February 1722).

H. Yule, Colonel.

"May it please you "Condore the 8th July 1703.

"Most Honoured Sirs.

"Haveing bin here now above four months I believe it my duty, to give your honours an account of this Island; the best I am able from my own

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[1] Capt. A. Hamilton (*New Account*, etc., ch. xlviii.) mentions "the reverend and ingenious Dr. Pound . . . and Mr. Solomon (an old acquaintance of mine)," as among those who escaped. But Dr. Pound, and probably Solomon, had gone to Camboja before the massacre, as appears from one of the India Office papers.

observations and what I could possibly learn from others, and this being the product of spare hours whilest no shipp was here, I will not in this mention anything to your honours but what perticularly relaites to this your honours Island.

"It lys at the enterance into the Bay of SYAM neare to the CAMBOJAN and CHAMPA shoars, being as by Mr. HENRY SMITH'S account thence: 30 leagues from the mouth of the river DINGMOY[1] (or new province) which is a little to the Eastward of CAMBOJA river: These CONDORE Islands also ly between the paralels of about: 8°: 36′: and 8°: 47′. N. Lattitude; But our ffort on the Maine Island lys by very nice observation in the Latt^{d}: of 8°: 41′ N.

"The Maine or bigest Island runs NE^{t} and SW^{t} about 12 miles in length, and about 4^{m}: in breadth, in its broadest part; It has thirteen other Islands lying round about it (as your Hono^{rs} will see in the draught, which I presume to send your Honours herewith), two of which are about 3 mile long and one broad: two are about a mile each way over: and two are about three quarters of a mile over: the other seven are very small. One of them is a bare rock lying about 15. miles Eastward of our fort; from which the inhabitants tell us they procure the birds nests, which are in these parts esteemed so great a restorative: The rest of the small Islands, are woody and produce little or nothing; But on the great or Maine Islands, are two or three large plains. The best and bigest is that where we are settled and the only one where the COCHIN CHINAS inhabit, it contains by esteemation Two thousand Acres of ground.

"We have Timber trees everywhere in great plenty, many of them strait, large and tall; generally very hard and of a close grain, some like Lignum Vitæ, others like Ebbony and other like Box. The Timber of the Dammer Tree (mentioned by Cap^{t}: DAMPIER) as to its graine very much resembles ENGLISH Elme but its heavyer. It seems to be very propper for building of shipps, especially those parts which must lie under water, for it has bin observed here that when other woods under water have been eaten by the worms, this has never bin touched, by reason (as may be believed) of that gummy juice with which it soe much abounds. And our Carpenter here tells us, the best time to fell these trees, is when the sapp is up: And yet we observe the inhabitants make their prows (or boats) with another sort of wood, which is also very heavy, probably because this is not easily cut into planks, espetially before it be very well dryed: for the gummyness soe clogs the saw, that 'tis very laborious to cut. With the juice of these trees drawn (as Cap^{t}: DAMPIER describes) the inhabitants make Dammers (or Torches) to use in their houses, and to goe a fishing on the Rocks. I have not seen any other use they put it to, and for that a little serves them. It much decays the tree, and altho it looks green and flourishing without, yet they rot within, and about the holes which are cut for drawing: and this rotteness about the holes has bin a great ease to our people in clearing the ground, for when we have cut a little round, the waite of the tree above, and the rotteness below makes it fall much sooner than could be expected.

"The wood of the wild Nutmeg tree is the lightest of any we have, the graine of it resembles that of ENGLISH Beach, it generally grows straight, it is proper for severall uses in building, as also for oars and small topmasts: But the best wood we have for yards and topmasts, is a tree which grows up to a considerable heigth, and then sends forth branches from which comes other branches, long and slender bending downwards, till they enter the ground and

[1] The river DINGMOY is apparently the *Donnai* of the French maps, which the Saigon river joins.

take root (as the tree does in Bengal vulgarly[1] called the Banian tree). The wood of this when dried is very light and tougher than ENGLISH Ash ; whilest it is green it may easely be cut into anything, but when it is dry, tis difficult to make it answer the tool, or to cut it smooth, the grain of it being soe extreamly cross haveing one part running thwarting, or counter to the other. There are severall other sorts of trees which grow like this, but their wood is heavyer and does not grow soe regularly, strait and tall, before they branch out.

"We have another sort of wood also very like in graine and toughness to English Ash, soe that this Island is a little overstocked with wood and Timber. very fit for all kinds of uses except masts for ships, but I question not but we have many trees which in case of necessity would serve for that also : there being severall sorts besides the before mentioned which we have not as yet tasted (as the Carpenters call it).

"As to the fruit trees here are sundry sorts growing wilde : I think the Mangoes doe not by any means come up to Cap^{t}: DAMPIERS account of them, for their season being towards the latter end of the dry time, and the trees growing on sides of hills, and in loose hollows and they want(ing) that nourishing moisture which is requisite to their due maturity, they are much short of those in BENGALL, but I believe if they were managed with a proper cultivation they might become equall to those of other countrys, and I believe the same of many other fruits growing here, soe that with all submission I wish your honours would think good to send an extraordinary good gardiner to reside here.[2]

"The Wild Nutmeg tree grows very straight and round, but seldome exceeds a foot, and never a foot and a halfe Diamiter; the fruit exactly resembles the true Nutmeg, having an outside coate, as thick as that on a Walnut, within this rind is the Mace incircling a thinn shell which incloses the nut. The Mace is not within the shell (as Cap^{t}: DAMPIER I think says). The nut has a rough harsh and hot taste, and some of them seem to have a little spicey smell and taste ; We have killed wilde pigeons with severall of them in their craws : Doubtless could some grafts of the true Nutmeg be brought hither, these by inoculation or graffting might be improved, and I am inclined to believe, by a right and seasonable graffting or inoculating one on the other, it might bring them to the spiceyness. An artist in such cases, I againe humbly commend to your Honours' consideration, which would be no less serviceable on the wilde grapes which we have here, in all respects like the true, as to its fruit, its growing in clusters on the trees, the leaves of the tree, and also the tree itselfe, which runs up and clings to other trees, or else spreads upon the ground where there is none to support it. The fruit never comes to perfection for want of cultivation, but is very much like our English sower grapes before they are ripe ; in tarts, etc., they are every whit as good as English green goosberrys.[3]

"The wilde grape mentioned by Cap^{t}: DAMPIER is of another kind and indeed here are two different fruits which will nearly answer his descrip-

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[1] In orig. transcript "vougarly."

[2] Dampier describes the wild mango here as "very juicy, and of a pleasant smell and delicate taste;" and Crawfurd also found "the common mango (*Mangifera Indica*," *Journal of an Embassy*, 2d ed., I. 305). The wild mango of India is, I think, hardly edible. The island trees were perhaps relics of old occupation.

[3] Crawfurd confirms the fact that an esculent grape grew on the island, and refers to Dampier; but Dampier's fruit is not a true *grape*, but one growing on what he calls a "grape-tree," and to be identified with one of those mentioned in the next paragraph by Catchpoole.

tion,[1] for they both there grow in clusters out of the bodys and limbs of straight trees of about a foot in Diamiter, they are both of a kind of winey taste, not much unlike grapes before they are ripe, but one of them is biger, and the other less then our ENGLISH grapes : the lesser when ripe is red on one side and a yellowish white on the other, it has a stone in the middle, and but little substance about it, altogether like a blasted cherry. The other is biger than a large musket bullet, of a greenish colour before tis ripe but then turns yellow : within this outside rind, which is pretty thick and soft, is the fruit, being three or four cloves inclosed in a thinn skinn, haveing in the midle a kernell between which skinn and kernell is the substance of the fruit, which is as juicy as the true grape. Some of these are redish when the outward rind is taken off, but they are generally white. Lemonade or Punch made with this juice is better than those made with Limes, Lemons or their juices, for it has a much more pleasant wineish flavour. Experience teaches they are of an astringent nature.

"The wilde Mangosteen and two or three other sorts of fruits growing here are in shape and make much like the affore mentioned, consisting of cloves included in an outward soft rind, each clove haveing a kernel in the midle: Their juice is more thick and clammy than that foregoing, and are about the bigness of a BURGOMY pear. Some of these fruits altho' pleasant enough by nature, yet they want the improvements of an artist, which I cannot too often humbly recommend to your honours to supply us with.

"The Arek nut (vulgarly called Beetlenut) is here very small, there are many of them, espetially on MONKS Island, but they seldome come to full maturity. The Inhabitants are very fond of those that come from CAMBOJA, which are as good as those in BENGALL and other places ; but the inhabitants often make use of a certaine root of a tree instead of the Areknut ; which has likewise a rough and hard taste, and being chewed with leaves and chenam, it makes the mouth and spittle red as the other does, and may have as much vertue, but is not so sweet, and is used only out of meer necessity.

"The Beetle leafe grows wilde here, and is as good as that in BENGAL, where they keep a great stir about it. They have in BENGALL gardens of it fenced round, into which they will let none enter that has any wound or sore upon them, nor a woman at any time, and yet here it grows on the hills and in the valleys without any care, and as good as ever I eat in BENGALL, where the custome of it amounts to vast summs. I have bin told, in DACCA only it amounts to five lack of Rupees p. annum.

"We have here the Plantaine tree in all perticulars like those in other places, and they are on almost every one of the Islands, but neither doe these come to perfection, growing ripe before they have the due fulness ; they are full of black hard seeds, soe that one may be rather said to take the smell and taste of them, which is very good, than to eat of them.

"Here is also a wilde lime, but its very small, and not fit for use ; doubtless it might be brought to good. The Island will beare them, for two trees which Mr. HENRY SMITH sent me from DINGMOY grow very well.

"The red peper so much used in almost all INDIAN pickles grows here in great plenty ; its a quick grower and may be increased to what quantitys wee please. Neare a small village of the inhabitants there is a feild or two of cotton

[1] These two fruits seem to be, the first, *Pierardia dulcis*, Jack. (otherwise *Baccaurea dulcis*, Müll. ; *Rambeh* of the Malays); and the other a sp. of *Lansium* (*Langseh* or *Langsat* of the Malays). Plates of species of *Rambeh* and of *Langseh* will be found in Marsden's *Sumatra*, 3d edit. Pll. VII. and VIII.

trees, doubtless formerly planted, but now I doe not see that they take any care to improve them, or indeed take any notice of them ; the Island may be made to produce what quantitys your honours think good.

" Bamboes are very plenty here, but they are not soe big nor soe strong as in BENGALL, but on MONKS Island and on BEETLENUT Island they are fitt for any common sort of Building.

" We have here a large sort of Rattan with which the inhabitants make shrouds and cables for their boats, but are soe cunning that as yet they will not let us see where they grow. As to the flower trees there are severall sorts ; some smell very fragrant, and here are many trees that have leaves of an Aromatick smell.

" We have here the Meyrtle, which is not much vnlike those in England, only much bigger.

" The Islands being for the most part sandy, and over run with shrubbs and over shadowed with trees, doe not produce any Variety of plants or herbs. On this maine (or bigest Island) grows Pursline, Mint, wilde Marjerum and wilde time. The inhabitants sow Onions, Cowcumbers, Goards, Millions, Pompkins, Patatoes, Rice and Maze (or Indian corne), all which the ground brings forth very plenty fully, with very little trouble ; which is something to be wondered at that these trees and fruits should flourish in a dry loose sand, of which the plains doe generally consist, but at first sight some looks like a black fat mould, but is not soe, as soon appears by drying some of it in the sunn. Att the roots or bottoms of some of the hills there is a good stiff blew clay, some of which with it halfe a mile of the ffort we have tryed, and it makes very good bricks and tyles, but as yet we are too few people to go on with that, Espetially till we have cleared the ground about us and cut paths in the Island.

" The land animals are Monkeys, Squirrills, severall kinds of Lizzards and Snakes, Scorpions, Centipees, &c. We have never seen a wilde hogg on any of the Islands, except some that wee set ashoar on our arrivall last yeare, which are now become wilde, and on CATCHPOOLES Island there is a breed of them which have endured the last dry time without any reliefe, soe will doubtless in a yeare or two become vastly numerous. The monkeys are like the common ones of other places. The Squirrils are of three sorts ; the first are white, inclining to yellow on their bellys and insides of their legges, but the rest of them is black all over. The second sort, or midle sized, are all over very black and the furr is very fine. I carried two of them last year to CHINA, and the CHINESE commended them extremely, and desired me to bring a quantity of them, but the inhabitants are soe used to their old track, and so very lasey, that I have not this year been able to procure any. The third sort is the least ; its a very small flying squirrel, haveing a flapp of his own propper skinn extended on each side from the fore to the hinder legg, which when he leaps serves him almost as wings, carrying him a great distance : his taile is something like a fine feather, having no hairs on the uper or under parts, but only on the two sides, he has white under his belly, and of a fox couller all along his back, and black mixt with these on his sides.

As for the animals of the Lizzard kind the first is the Alligator, of which the Inhabitants say there some few, but I have not seen one here. The second is the animal mentioned by Cap^{t}: DAMPIER to be like the Guano, here are a great many of these of severall sizes ; we have killed severall of 11. 12 and thirteen foot in length, and as big as a man about the middle, the slaves brought from BATAVIA eat them, and when skinned &^{ca}. their flesh looks very well ; the slaves say there are many of them on JAVA Island, and the PORTUGUZ call them

Odumbas; we have not found them any ways hurtfull, save that they often kill our fouls and eat them. Other Lizzards are very numerous, of the common ordinary sizes, tho' different species, but I will only trouble yours honours with an account of the Tockaie, whose head, mouth and eyes are biger than the common Lizzard, his skinn is spotted with black and red spots; some say a lickquer which comes from him is very venimous, but I have not seen any prooff of that, but I have run my sword threw one (alive) severall times and blood never came from him, but at distant spaces that afore mentioned lickquer has fallen from him; he makes a noise like some human voice pronouncing the word *Tockaie*, four or five times, sometimes six, but very seldome seven times togeather, and then is silent. An acco^{t} of this Lizzard or Tockaie, as also the figure of him, is in Pere TACHARDS voyage to SYAM.

"We have snakes of five or six different sorts, some are blew, others yellow, others differently speckled; they are generally very slender and long in respect of their bigness, five and six foot is an ordinary length, but the bigest and longest I have yet mett with was thirteen foot and a halfe long and but seven inches and a halfe round the bigest place, he was taken with a Duck in his mouth, which being rescued from his jaws soon dyed, whither from the venom or the bite is not certaine. I had him skinned and his belly opened, wherein were the leggs, wings and bones of another Duck, his skinn was chequered with variety of coullers. The inhabitants tell us that only the yellow snake is venimous and that where he bites it is certain death. The scorpions and centipees are not numerous, nor anything that I can percieve different from those in other places, the former are small, and perhaps only what were brought in our things from CHINA, but the latter are of a large size.

"I shall not presume to trouble your Honours with an account of the insects of this island, only of one, it being a great curiosity, and none of us have ever seen such before: it is a small slender worme, about three inches in length, much resembling a centipee only slenderer, and its legges are shorter, smaller and much more numerous; where ever he creeped or moved in the night he left behind him a traine of light like a bright fire, which would also stick to his fingers and hands that but touch it, and stick thereon some time, and yet when brought to the light there apeared no manner of unctious moisture about him; by seeing and touching this in the darke, were it not for its motion, no one could distinguish it from the Chymicall preparation in our surgery chest called Phosporus. The first we ever saw fell on my forehead, which I wyped of with my hand, but it was very surprizing to see the light on my hand and forehead, and on my clothes where it fell, but it does no harm in the least.

"The wilde cocks and hens are in good plenty, which certainly came originally from a tame breed, they being in couller and bigness, &c. much like the small sort called CHAMPORES,[1] severall of which we have had brought us from CAMBOJA. We have two sorts of wilde pigeons here, the bigest sort are white, with some few black feathers in their wings and tails; the lesser sort are blew, about the bigness of those we have in our Dovehouses in England; both kinds are very good, and plentyer than powder and shot.

"Among the singing birds that which in BENGALL is called the Minaw is the only one that comes within my knowledge, but here are severall sorts of small birds.

"We have also Batts of all sizes, some as bigg as a large kite; we have no kites or crows on this Island.

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[1] The Bantam fowl (see *Anglo-Indian Glossary*, s.v. *Bantam*).

"As to the fishery the Islands here (I believe) are inferiour to none, to none indeed that ever I have seen. The green Turtle is large, very good, and I think excells that of ASSENTION; its soe plentyfull in the season of May and June, that the shoars are all strawed with Turtle by the inhabitants, over and above what they carry home to eat, for the chief end of their catching them is, for the thinn Tortoiseshell on their backs, which they take of; they lay fire on them to doe it, and leave the bodys on the shoar halfe dead, excepting some small parcell they carry to their houses; these thinn shells they carry or send to COCHIN-CHINA and sell them there (they have told me) for sixty or seventy *pellys*[1] each turtles shell. The COCHIN-CHINESE put a round peice of it (of four or five inches diamiter) on the midle of the outside of their basket hatts, but I cannot learne they have any other use for them. We have thornbacks here, with severall other sorts of the Raia kind; here are in great plenty very fine SPANISH Mackerell, Soles, Turbits, Mullets, Bonitas, Albacores, Daulphins, Paumphlets, and divers sorts of Rock fish, and an innumerable many other sorts of scaley fish very good, which none here have seen in other places. Also we have great store of oysters, cockles, crabbs and lobsters, but this last I think is rather to be called the Sea Crawfish, for they have not the two great claws of the Lobster, but differ in nothing else, being full as good: I have weighed one alive of four pound and three quarter lb. pound averdp^{s}: and I have bought sixty one of common sizes for three quarters of a SPANISH Dollar; there is hardly a day passes, but the inhabitants bring some new sort of fish.

"In the valley where our ffort is (and in some other places), are a few pools of standing fresh water, which continue all the dry season, out of which we have had very good Eles and several other good fish.

"This yeare of 1703, has proved a very dry one, and the rains are soe backward that on the 10 of July there was not one running fresh water, and I am told by the LIAMPOS people who were here the 15 June 1702 that the Rivelets in all places run with fresh water flush into the sea. On the 28th June 1702 we arrived here, and then found such runnings of fresh water that one would think a month or twos raine would not produce the like. Running fresh water of January to June or May (which is the dry season) is the only thing wanting, but other fresh water is always to be had very good. In any of the Valleys wells may be made with a very little trouble: in some places they need not digg above two yeards; ours in the ffort is not above sixteen or seventeen foot deep, and very good water, bears soap and answers in all things, but being in sand and wanting artists, it needs clearing once a month.

"As to our ffort it may seem by the draught sent your Hono^{rs} by the *Macklessfield* Galley to be much otherwise than it really is, for as yet it can hardly deserve the name of a ffort, it is only an inclosure made with two ranges of stakes, with hurdles fastened to them and in some places filled with sand. The stakes are about six foot high, made of wilde Arektrees; and indeed it cant as yet be expected it should be otherwise considering the few of our hands, and amongst those we have only one carpenter, and altho' he be a good and a laborious man yet hee is pretty well in years: As for Mr. RAY who came out for a bricklayer, he knows nothing of it, not so much as how to handle a Trowell. Carpenters, Bricklayers, and a Smith or two are the only artificers we want, and I humbly recommend to your Honours to supply us with bricklayers, and Carpenters or Sawers, the last of which can work the gross work of a carpenter; had

[1] I cannot trace this word, but from a subsequent passage it would seem to mean Chinese *cash*.

we these Artificers and a few slaves more, I doubt not but we should soon build yours Honours a good ffort here, with Store Houses, Warehouses and all things necessary to it. This whole Island and especially this valley is a loose sand, soe that there is no thoughts of stone walls, for it would take up a vast time and charge to make the foundation, which would require to bee extrordinarily well pyled, and the stones here are soe hard that a common tool will not touch them. The method which at present (by a generall consent and advice) we propose is, to raise two ranges of timbers, the one distant from the other the thickness of the wall, and to bind these with cross girders, and to line them on the insides with CHINA deals, CONDORE planks, or the wilde betlenut or Arek nut trees split in two (which are very easily done, and are strong enough for this purpose), then to fill it all up with sand, by which a good ditch will also be made round the new ffort; and lastly, to run up a thinn coate of brick on each side. The Timber worke is to keep in the sand from bursting out on either side, and if in time it should grow rotten, the sand ere that will (we believe) be soe well settled that it will not have any force or weight on the side brick walls. This we imagine will be done much sooner and easier and with much less expence than any other way. I am of opinion it cannot this way cost your Honours a thousand pound sterling, besides the expence of about tenn bricklayers and as many Carpenters or Sawers, for the greater part of this worke may be done by slaves and others who are not mecanicks, for the maine of this worke is to be done by any that can endure labour.

"The inhabitants are COCHIN CHINAS, and I estimate of men, women and children not above a hundred; they are idle, lazey people, and I believe they come over hither only to live at ease, and (away) from under Government. I cannot find they carry anything from hence to the maine, but some of the before mentioned Tortoisshell and about twelve or fourteen new Prows a year which they build, being very sorry vessels, sowed together. We can't find they bring anything as yet from the main; but we heare its well Stored with provisions: which we expect will come with Mr. SMITH, &c., in larger quantitys than we need. The only labour the inhabitants doe is sowing Rice, maze, &c., once a yeare, and fishing, and now and then makeing a new boate or repairing an old one. They all live in our valley, in three small villages—the farthest within two miles of the fort. In each village one is Superior, or a sort of a governing mandarin to the rest, but if anything extraordinary happens, they all meet, and if they can't determine it, the mater is referred to the Governor of Dingmoy, and the concerned sent to him by the very first opertunity. They seem to be a good natured people, and they bring us fish, fouls, and every thing the Island affords, which at first they would truck, fresh water only for rice. Soon after they desired *pellys* or CHINA cash, but they are already become very well acquainted with SPANISH Dollars, yet they never weigh them, and take anything that looks round and white, but they will not take any that are cutt. They are not shy of their women, but yet they are not soe free neither as some have reported, and we have certainly the greater respect for not medling with them.

"I recon (on the whole) the Island is very healthy,—certainly it is one of the coolest places in the world that lys in soe low a latitude; and of the people that have died here (tho' it sounds a great many, and God in mercy let it stop) it is to be feared most of them have bin extreamely to blame, some have died in the worst course of phisick, the cause of which they brought with them from England or Batavia. Some others (nearly a quarter of what we have lost) were drownded in a Prow (or boate) both which misfortunes might have befallen them in any the healthiest place in the world. The inhabitants have their healths very well, and

no seasoning at their first coming, for they are not natives any more than we, and I bless God we CHUSANERS[1] have hardly had our fingers ake since we came hither. And the Soberest and most active on the Island have had the best health.

"I have heard that some speak against the Harbours, and perticularly Capt. JOHN ROBERTS; but from the best information I can get from those who have had most experiance of them, this is the best all about the island, and altho' it has some corally rocks at bottome in many (but not all) places yet it lys soe that any ship which cuts her Cables can always put to sea, one way or other, and soe need never loose a shipp. If ships come to ly here long, they must be advised to Cackle[2] their Cables. I am sure its beter rideing here than in MADARASS or BALLASORE road. In the SW^t harbour (alias DAMPIERS BAY), which I am told Capt. ROBERTS said here he would commend to your Hono^rs, are such gusts come from the hills, that anchors and cables can hardly hold, and the mud is of that nature that it rotts cables beyond beliefe; also in that Bay I must note to your Hono^rs that there is no fresh water about six months in the yeare, and here we have always great plenty in many places, even in this soe uncustomary dry season.

"We have had but three Juncks here to trade, since my last comeing hither, and they have come loaden with provissions, the only thing which ships lying here used formerly to need; but I doe faithfully assure your Honours I have no feare of vessels in great numbers coming hither with all sorts of goods, soe soone as they heare we are settled here, and governe as in your Honours other factorys.

"To bring the CHINA trade hither I am of opinion your Honours should order one or two ships to ly here with money and goods, and not one that yeare to goe to CHINA; then would the CHINESE know where to find us, and perceive that they must come to us, as they doe to the DUTCH: This may be the loss of a season, and soe of too great consequence to be ventured at without your Honours positive orders. But with all humble submission I lay it before your Honours and think the sooner you please to order it the beter, for I am of opinion ere such your Honours orders can reach this place, it will be time to put them in execution, and this place will be equiped to answer its part in all things.

"I humbly beg your Honours will accept this (to the best of my knowledge) faithfull account, it not being taken up barely upon trust: I hope your Honours will excuse all faults and errors in it, since you are sensible its not in my power to adorne my description with elegant language and fine flourishes. I have no other aime herein than to express my humble duty to your Honours, and rejoyce that you have pitched on a settlement which all must commend, and which Pere FFONTANEY told me the Jesuits of CHINA have for severall years bin pressing their Company to take possession of. I will ever be Zealous in promoting your Honour and interest, being of nothing more desireous than to be successfull in your Honours concerns, and by my actions and endeavours to convince your Honours that with all sincerity I am—

"Most Honoured Sirs
Your Hon^rs most faithfull most obedient
and most humble servant
ALLEN CATCHPOOLE.

"The 13^th July 1703. closed: the *Samuel and Anna* being arrived at 5 P.M.

"I have also presumed to inclose herewith an account of some CHINA goods: whence they come, their quantitys and prices. I cannot averr to the truth of it

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[1] Viz., those who, like the writer, had been residents of the factory at Chusan.

[2] "KECKLING, or Cackling, is covering a cable *spirally* . . . with three-inch old rope to protect it from chafe in the hawse-hole."—SMITH'S *Sailors' Word-Book*.

all, but I hope your Honours will accept it the best I could get it. Capt SHERSTONE assures me he sent your Honours a draught of this Island by the *fleet* frigat and by the very first conveyance resolves to send your Honours another, with some amendments, soe I have not sent any draught as before mentioned.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

AN Ordinary Meeting of the Society was held in the Freemasons' Hall, Edinburgh, on 11th January, Mr. Coutts Trotter presiding. Mr. Henry Soltau, of Upper Burma, read a paper entitled "Across China; from Bhamô to Shanghai." A vote of thanks was awarded to the lecturer on the motion of Mr. W. B. Blaikie, seconded by Dr. Dods.

A Meeting of the Glasgow Branch of the Society was held in the Hall of the Philosophical Society, on Wednesday, 18th January—Sir J. N. Cuthbertson, Vice-Chairman of the Branch, presiding—when Mr. A. Silva White, Secretary to the Society, read a paper on "The Antarctic Regions."

At a Meeting of the Geographical Club, held in the Society's Rooms on the evening of the 21st January, Mr. A. Silva White submitted for discussion a paper on "The Known and the Unknown Conditions of the Antarctic Regions."

GEOGRAPHICAL NOTES.

ASIA.

Persia.—Our Corresponding Member, Dr. Emil Tietze, writing from Vienna, informs us of a new expedition which is preparing to start next April for the exploration of Persia, with the special object of inquiring into its geology and geography. The expedition has been set on foot by Dr. Polak, himself well known for his explorations in Persia, and will be placed under the command of Professor Suess's assistant, Dr. Rodler, who has already done excellent work in the neighbourhood of Lake Urumia and near Maragha. Although a great number of books have been written on Persia, they are mostly wanting in scientific merit, and are too full of personal detail. Dr. Rodler's journey will therefore be followed with interest. He proposes to penetrate the little-known regions peopled by the Lurs and Bakhtyaris, and to carefully explore the territory between Ab-i-Diz, the upper course of the Karun, and the upper course of the Zayende-Rud, giving special attention to the Zerdā-Kuh range of mountains. He hopes to come out at Mohammerah, on the Persian Gulf, investigating the geology of the country on the way. He will also, being a physician, give some attention to the distribution of certain diseases in Persia. We may mention that the region about to be explored by Dr. Rodler was the scene of the early adventures of Sir Henry Layard among his friends the Bakhtyaris, so graphically described in his recent volumes.

Disastrous Inundations in China.—The Hoang-ho, or Yellow River, popularly known as "China's Sorrow," has burst its banks about 300 miles from its mouth, and flooded about one-sixth of the inland province of Ho-nan. The news of this terrible calamity, which occurred last autumn, has somewhat tardily reached

this country. It is scarcely possible for Europeans to conceive the extent of this disaster. As a leading article in the *Times* puts it :—"For 500 years prior to 1852 the river ran southwards from Kaifeng (the capital), and entered the Yellow Sea to the south of the Shantung promontory. But in 1852 it burst its northern bank in the neighbourhood of Kaifeng, and cut a new bed for itself through the northern part of Shantung into the Gulf of Petchili. The new and the old mouths of the river, after the inundations of 1852, and the change of course resulting from it, were about as far apart as Newcastle is from Exeter. The intervening country is low-lying and flat, and the volume of water brought down by the Hoang-ho is far greater than that of even the largest rivers of Europe. We can form some conception of the change thus wrought by supposing that a river far greater in volume than the Rhine had suddenly changed its course at Mayence so as to empty itself into the Baltic instead of the North Sea."

During the last 2000 years the Yellow River has changed its course some five or six times ; of the last occasion in 1852, Europeans learned a few scanty particulars some five years after the disaster ; that, at the present day, we are placed in possession of such comparatively easy and complete information of a fresh inundation, is a striking illustration of the opening up of China to foreign interests.

During the past thirty years vast sums have been expended on watching the conduct and course of the Hoang-ho, which are for ever changing ; officers of the highest rank and greatest experience, and a whole army of labourers, have always been kept on the spot for this duty, ready to strengthen any point in the banks which show signs of weakness. No year has passed in which the river has not broken through at some unexpected spot and flooded large districts. These partial inundations, however, have been slight as compared to the most recent disaster : the waters of the river, deserting their former bed, and swollen by flood and the accession of tributary streams, have poured down on a thickly inhabited plain, spreading death and desolation to an unparalleled extent, and forcing an entirely new course for themselves to the sea. A correspondent of the *Times* in Peking supplies some interesting details of this event. He says : "The local streams were swollen by the stormy showers of September, and the heavy freshet coming down the Yellow River, which in Ho-nan is something over half a mile broad, added to the strong wind, caused the waves to dash violently against the embankment of the south shore below Cheng Chou, carrying away first the protecting fascines, and not long after the earthen wall behind them. The breach extended at first for only 100 yards, and the main body of the stream continued in its own channel. Frantic efforts were made to close the gap, but its sides rapidly crumbled away till it widened to a breadth of 1200 yards, through which issued the whole contents of the river. Parallel with the Yellow River, between it and Cheng Chow, runs the Lu Chia River, a water-course of no size. The escaped torrent poured into the valley of this stream, rushing down it towards the east. Twenty miles from Cheng Chow stood Chung Mow, a walled city of the third rank, in the district of which it is the chief town. A hundred villages were swallowed up entirely, and the lands of three hundred more were inundated. The city itself is reported officially to be still standing, encircled by the waters, but private accounts represent that both it and its population are buried beneath the waves. The flood, still keeping the line of the Lu Chia, then turned southward, a mass of water from 10 to 20 feet deep in the midst, and stretching in width for 30 miles, without counting less important off-shoots which invaded the valleys of adjacent streams. Chuhsien Chen, one of the principal trading centres of China, lay in that course,

but, fortunately, being on higher ground, escaped with the loss of a few suburbs. Seventy miles due south of Kaifeng the Lu Chia joins a larger river coming from the west. Not far below the point of junction the flood rose to a height even greater than before. The country there traversed by it is low-lying and very fertile, and the population correspondingly dense. In a tract 30 miles square, fifteen hundred villages were submerged. Not far beyond this locality the inundation passed into the province of Anhui, and the destruction of property thence all along the valley of the Huai River to the sea must be immense. The number of persons drowned in Ho-nan can never be reckoned with any approach to certainty, and can hardly even be guessed. Hazarding a conjecture, it could not be said to be less than one million, and probably not so high as two. Still, a European at Pekin, who, by his relations with the Chinese Government, is in a position to be better informed than any one else, has put the number at seven millions."

Orders have been issued to close the breach and confine the waters in its old channel with all possible speed. Besides a private donation of the Empress, amounting to £25,000, a sum of £500,000 has been made over by the Imperial Treasury to the local authorities for the work of restoration, and a further sum of £75,000 for the relief of the sufferers.

The *Times* correspondent makes some instructive remarks on the cause of the inundations. "The incurable troubles," he says, "which have been so long connected with the Yellow River are primarily caused by its tendency to silt. In its middle course it descends into China from the high Mongolian plateau. The great change of level gives extraordinary velocity to the stream. One cannot state the number of miles it runs per hour; but it is said that at one of the principal ferries the boat is often carried down three miles, though the crossing is only half a mile wide. Secondly, the land of North-west China, to the depth of several hundred feet, consists principally of the famous 'loess,' or yellow earth, a soil of inexhaustible fertility, if the rainfall be sufficient. The loess earth, which is very light and friable, is carried away in immense quantities by the swiftly-rolling waters, and from the colour it imparts to them the river derives its name. The quantity of earth held in suspension is so great that, whenever, as happens in seasons of drought, water from the river is admitted to the Grand Canal, it is necessary to dredge out the mud at the bottom of the canal before the passage of the grain fleet in the following year. The silt brought down, as just described, from above is deposited all along the lower course of the Yellow River, particularly near the coast, where the proximity of the sea checks the speed of the current. Year by year the river shallows, its banks being gradually raised in proportion, till at length not merely the surface of the water, but even the bottom of the bed, is higher than the level of the surrounding country. That this is really the case has been proved by Europeans who have visited the old channel left dry in 1852, and have found themselves walking up hill as they entered it through a gap in the massive walls. Under such circumstances, despite the watchfulness of the guardians, sooner or later a breach cannot fail to be made, and one can easily imagine the terrible nature of a flood thus pouring down from a higher elevation on to the plains below. Even further inland the evil makes itself seriously felt, as the passage of the water is immaterially retarded by the shoaling lower down, with the result that there is an increased pressure on the banks, and a greater tendency to inundation at the season of high water. The conditions of the Yellow River thus differ from those of any other great river in the world, and its conservancy is a problem of which the difficulty is immediately apparent. Nor with these facts before us need we

try to account for the changes of course which the stream has undergone at different periods by imagining, as some authorities have suggested, that the land has been subjected to changes of level by the rising or sinking of the earth's surface."

East Asiatic Currents.—Legend, tradition, and geological evidence all concur in demonstrating that the regions now covered by the waters which unite the Gulf of Petchili with the Yellow Sea were formerly dry land, and that the mountains of the Chinese province of Shan-tung were once connected with the peninsula of Corea. It would only require a comparatively insignificant elevation of the bed of this strait to bring it level with the adjacent exposed surface of the earth. The Sea of Japan, too, is not less shallow, and the greatest depth of the strait on the south of Corea is only 80 feet.

Of the *warm* currents in this part of the world, by far the most important is the so-called Japanese Gulf Stream. Originating between Formosa and Luzon (Philippine Islands), near the Bashee group of islands, and north of 20° N. lat., this current flows northwards, washing on its way the west coast of Formosa and the shores of the southern islands of the Liu-kiu Archipelago, till on reaching lat. 26° N., it bifurcates. The main current bends towards the north-east, and skirts successively the south-eastern shores of the large islands of Japan; then north of 38° N. lat., it deflects still more towards the east, and finally, some distance south of the Aleutian Islands, strikes off towards the western coast of North America. Only a very narrow stream of the main current seems to continue its northerly direction beyond 38° N. lat., and to flow between the coast of Kamchatka and the Aleutian group towards the Behring Sea. The branch which leaves the principal current north of the 26th parallel continues to pursue a northerly direction, washing the west side of the island of Kiusiu and the shores of the Goto group, then, leaving Tsushima on the left, it passes through Krusenstern Strait into the Japanese Sea. It next runs parallel to the western side of the Japanese islands, sending off a weak branch through the Tsugaru Strait, whilst the remainder penetrates into the Sea of Okhotsk through the Strait of La Pérouse, but soon dies away in the southern part of that sea. This western arm of the Japanese Gulf Stream sends off, south of Quelpart and of the 32nd parallel, to the left, a branch which passes up on the west of Quelpart, and flows along the south-west of Corea, finally dying away in Empress Gulf. The Japanese Gulf Stream is characterised by a higher temperature than the water that surrounds it; north of Formosa it is 4° to 5° C. higher. With a clouded sky the stream is grey in colour, but in sunshine a very deep blue. On 19th December 1873 its temperature, at 29° 24′ N. lat. and 128° 18′ E. long., was 23° C. In late summer, at 39° N. lat., there is a rise from 20° C. to 25°·5 on passing from the water of the ocean to that of the Gulf Stream. In 1827 (June) a difference of 7° C. was observed, the observations being taken on successive days, at 38° 30′ N. lat. and 154° 16′ E. long. on the first day, and at 40° 7′ N. lat. and 156° 53′ E. long. on the second. In winter, during the space of a few hours' travel, the difference often amounts to 8° to 10° C. And at all seasons of the year a rise of 6° to 8° C. in the temperature of the water is observed between Vladivostok and the south-west extremity of the island of Yezo. In proportion as it advances northwards, the stream decreases in speed, depth, and temperature, but increases considerably in breadth. In comparison with the Atlantic Gulf Stream, the Japanese is always, at the same corresponding depth, from 2° to 3° C. lower in temperature.

The *cold* currents of Eastern Asia belong, in respect of their origin, to three seas

—the Okhotsk, Behring, and Yellow. In the first-named, three are enumerated: (1) From the north-west of the Sea of Okhotsk comes a cold current, the Liman, which, after hugging the shore of the mainland, passes between Saghalien and the Russian Maritime Province, and then proceeds down the Gulf of Tartary, washing on its way the shores of the Maritime Province and Corea, as far as Broughton Bay, on the east side of the last-mentioned country. Here it mingles with the warmer waters of the Japanese Sea. (2) The eastern side of Saghalien is washed by another current from the Sea of Okhotsk, which finally meets, at Cape Patience, the warm water of the La Pérouse branch of the Japanese Gulf Stream, and disappears. (3) The Kurile current originates in the Gulf of Penjina, in the extreme north-east of the Sea of Okhotsk. Passing along the west side of Kamchatka, it receives off Cape Lopatka, the southern extremity of that peninsula, a weak current from its eastern side; then, after skirting the Kurile Islands, it touches the north and east of Yezo, and below 39° N. lat. contracts to a very narrow coastal strip in summer, but in winter penetrates one degree further southwards. Off the north of Yezo its temperature barely reaches 5° C. even in the middle of summer. In colour it is dark and muddy. From the Behring Sea issues the Behring current, having a south-easterly direction, and passing between the Aleutian Islands and the south-west extremity of Alaska. After crossing the Japanese Gulf Stream, it reaches the Pacific coast of the United States near San Francisco, and finally disappears in 20° N. lat. in the North Equatorial current. Corea Bay in the Yellow Sea gives birth to the Chinese current, which proceeds south-westwards till it strikes the Shantung promontory of China; thence it follows the Chinese coast almost to the Strait of Formosa.

Lastly, there is the steady set of the surface water of the Yellow and Eastern or Chinese Seas, under the influence of the south-west monsoon, towards the south-west coast of Corea. Hence, in spring, the average height of the water on this coast is at least $1\frac{1}{2}$ to $3\frac{1}{4}$ feet higher than it usually is in winter. Nevertheless, owing to local conditions, the bays of south Corea are in summer very warm, and in winter very cold.—Lieut. Adolf Glocker, in *Mitteilungen* of Vienna Geog. Soc., Bd. xxx., No. 9.

AMERICA.

M. Coudreau's Explorations in Guiana.—The remarkable journeys of this energetic traveller do not seem to be meeting with that recognition from the world of stay-at-home geographers which they undoubtedly deserve. To travel for seven successive months down the rivers and through the forests and across the mountains and lakes of an unknown region in South America, without resources, with no other assistance than that to be obtained from the native Indians, and to perform most of those journeys on foot, with a single native guide of whose language one is ignorant, is surely no light feat to have accomplished. Yet M. Coudreau, starting from Manaos on the Rio Negro, in the north of Brazil, ascended that river (275 miles), and the Branco (415 miles); traversed a plain some 275 miles long by 135 broad, with an area of 38,500 square miles, which extends between two important chains of the central Guiana mountain system, and is watered by numerous large rivers, which go to feed the tributaries of the Amazon and the Essequibo; forced his way across a complicated system of mountains, paddled down the Yaor, an important affluent of the Essequibo, then up this last river, almost to its sources; travelled on foot up to the mountains again, and reached the source of the river Trombeta, which joins the Amazon; and once more crossed a portion of the system back to Manaos. Such is a bare out-

line of M. Coudreau's itinerary. The broad plain spoken of above is bordered on the east by a chain of mountains, called the Mountains of the Moon, and ranging from 2500 to 3000 feet in altitude; they were discovered by the French traveller, and crossed by him several times at their widest part. They culminate in a peak (Kaïrrit = Moon), lying to the south of the main chain, and nearly 5000 feet high. Beyond this plain lie the river Kuyuwini, a left-hand tributary of the Essequibo, with its right bank bordered by the huge forests which stretch right away to Cayenne, and the Yaor, another tributary of the Essequibo, which it joins a little before the Kuyuwini. Just above its confluence the Yaor is about 55 yards wide, and has a volume equal to that of the main stream. The region through which these rivers flow is at first desert in appearance, but they soon enter the forests, where many pools and lakes are formed, and from which they are fed by numerous subsidiary channels. As one ascends the Essequibo one gets frequent glimpses of the mountain masses on the right of the river, which rise up one behind another connecting the Mountains of the Moon with those of Trombeta. These mountains are ruptured cordilleras, formed of broken chains lying in gigantic masses, some of them 30 miles in length, and rise abruptly from the surface of plateaux of moderate elevation. The Essequibo has its origin half a degree further north than is represented on English maps. At first it flows between mountain chains that range in height from 1650 to 3300 feet, and is very sinuous in its course, and full of rapids. In consequence of its many windings, Petermann and the British cartographers thus make the river too long by a degree.

The native tribes of this part of South America belong to two categories—the peaceful tribes and those which delight in war. These latter M. Coudreau of course avoided as much as he could. Of some of the former he records very interesting observations. Amongst the most miserable are the Tarumans, an ugly and timorous race, who tattoo their bodies. A decided contrast to these people are the Wayéués, who are handsome, with fine features and a majestic bearing. In fact, they belong to the aristocracy of the Guiana tribes. In M. Coudreau's opinion, they ought, perhaps, to be regarded as pure Caribs. Yet, in spite of their tall stature, they are very gentle and timorous. They are fond of adorning themselves with several of the usual ornaments of savage races, and wear their hair parted in the middle and drawn to a queue at the back of the head. They are also very fond of the flute, nearly every Wayéué carrying one with him constantly. Another product of their dexterity is a kind of thread, which they make from two species of vegetable fibre. The finest race of all are, however, the Japii, very many of whom have blue eyes and fair complexions their skin being of a light yellow tint. They are less timorous than the tribes just mentioned. Whilst the men of this race, however, are beardless, their next neighbours, the Tucanos, have moustaches, and high cheek-bones and oblique eyes. In manner they are silent and somewhat cold, with a slight air of melancholy. In their persons they are ugly and dirty. They are probably the descendants of an aboriginal race.

Sick and greatly enfeebled by the sufferings he had undergone, M. Coudreau arrived at the Rio Branco, and commenced the descent of that river on the 22d February 1885, finally reaching Manaos on 6th March.—*Bull. Soc. de Géogr. de l'Est*, 4e trim. 1886 and 1e and 2 trim. 1887.

AUSTRALASIA.

New Guinea: Recent Exploration by Mr. Forbes.—Mr. John Douglas, Commissioner of New Guinea, has received news from Port Moresby to the effect that

Mr. H. O. Forbes had returned to that place from an inland expedition. Mr. Forbes left Port Moresby on October 1, in company with Messrs. Denis Gleeson and George Belford, and two South Sea Islanders. The party had with them eight pack-horses and provisions for eight weeks. They formed a main camp fifty or sixty miles north-west of Port Moresby, on the eastern slope of Mount Owen Stanley. The islanders were left in charge of the camp, while Messrs. Forbes, Gleeson, and Belford extended their observations in the direction of the mountain. They reached the base of the mountain at about twenty-four miles from the main camp, but found it impossible to proceed further in consequence of the superstitious fear and hostility of the natives. After a difficult and dangerous march they returned to the main camp on October 31, and found that it had been looted, there being, moreover, no signs of the South Sea Islanders left in charge. With the horses, however, which they found, they returned safely to Port Moresby. The islanders had previously reached there after great difficulty. According to their representations, they had been attacked by a formidable body of natives, and had to make the best retreat they could. Mr. Forbes, unfortunately, lost some of his instruments, which were amongst the camp equipage. He was able during the trip to make some valuable additions to the geographical knowledge of the country. Mr. Douglas has been advised by the Colonial Office that he will be required to proclaim sovereignty over certain points on the coast line of New Guinea, but has not yet been informed as to the forms to be adopted. He is in daily expectation of receiving further instructions in the matter. Meanwhile he will proceed to the southern colonies to receive payment from them, and to close accounts in connection with the protectorate. As soon as sovereignty is proclaimed, and letters-patent issued to the administrator, all matters in connection with the protectorate will come under the operation of the Queensland New Guinea account. Mr. Douglas regards the New Guinea Bill just passed by the Queensland Parliament as admirable, inasmuch as it will secure stability and continuity in the administration of New Guinea. He considers that great patience is required in dealing with the large native question involved in the assumption of supremacy in New Guinea.—*Melbourne Argus*, 19th Nov. 1887.

Recent Explorations on the West Coast of Tasmania.—Under this heading Mr. C. P. Sprent, Deputy Surveyor-General of Tasmania, contributes to the *Trans. and Proc. of the Royal Geog. Soc. of Australasia, Victorian Branch* (vols. iii. and iv.), an account of a part of our Australian colonies about which our information hitherto has been somewhat meagre. The paper is illustrated by a useful map, on the scale of 7½ miles to an inch. Generally speaking, from Cape Grim to South-West Cape the coast-line—that is, of the entire western coast—consists of "low heathy hills and bare rocky mountains, alternating with dense forests furrowed with deep gullies. The prospect inland is made up of successive chains of rugged mountains, snow-clad during eight months of the year. . . . With the exception of a few patches near the sea-coast, the whole district is devoid of any herbage capable of sustaining stock, and but very small areas are capable of being brought under cultivation by any ordinary means. Exposed to the full force of the gales sweeping up from the Antarctic seas, the climate is so extremely wet and cold that rarely a week passes without rain, and it is recorded that during one particular year there were only forty-two days without rain or snow." The timbered portions of the country are moreover covered with one or both of two varieties of scrub, which are of the densest description imaginable; every step has literally to be cut with an axe. Add to this the absence of grass and

the scarcity of game, and it will be understood with what difficulties the explorer in this island has to contend.

In the year 1859 Mr. Charles Gould was appointed Government Geologist, and one of the first tasks he undertook was to examine the country around Macquarie Harbour and the mountain close by, known as the Frenchman's Cap, with the view of ascertaining whether gold was to be found in that locality. In two expeditions which he conducted he failed to attain his purpose. Mr. James Smith, however, had better fortune. Some time afterwards he discovered tin in workable quantity at Mount Bischoff, in the neighbourhood of the head-waters of the river Arthur, and some 60 miles nearly north of Frenchman's Cap. This discovery led to the finding of tin, bismuth, antimony, and other minerals on Mount Ramsay, lying to the south of Mount Bischoff. At length Mr. Sprent was commissioned by the Government to explore, prospect, and map out as much of that part of the country in which these discoveries had been made as circumstances would permit. Mr. Sprent commenced operations early in 1876, by cutting his way through the dense scrub to the Meredith Range, which extends southwards between Mount Bischoff and the Pieman River. This stream, which lies "at least 7 miles further south than represented on the official map," was 120 yards wide in its upper course, where Mr. Sprent came upon it, and it had precipitous banks, and was impeded by rapids at every half mile. This expedition established the fact that a zone of metalliferous country (yielding tin and gold) extended from Mount Bischoff to Mount Heemskirk, near the west coast, south of the Pieman. In the following year Mr. Sprent went north of Mount Bischoff, his object being to fix the precise position of the confluence of the river Hellyer with the Arthur, as well as to prospect for mineral supplies. In the last month of 1877 the same explorer examined the country between Mount Bischoff and Granite Tor (lying to the south-south-east), a quantity of carbonate of copper being found in the gorge of the river Macintosh, a tributary of the Pieman. Meanwhile another party, Messrs. T. B. and J. A. Moore, and Mr. James Andrews, had succeeded in reaching the stanniferous region of Mount Heemskirk from Lake St. Clair, at the head of the river Derwent.

This sketch of the history of exploration in the north-west of Tasmania is followed by a brief account of the leading physical features of the same region. "The central portion of Tasmania is a greenstone plateau, having a general elevation of from 2000 to 3000 feet above the sea ; the highest mountains attaining 5000 feet. In this plateau are situated the lakes from which issue the head-waters of all the large streams which go to form the Derwent, Mersey, Forth, Pieman, and Gordon Rivers. On the northern side the plateau slopes gradually down to the sea, sending out a series of sharp spurs, which form dividing ranges between the various rivers of the north-west coast. On the western side the plateau is bounded by a series of lofty mountains, including the Cradle Mountain and Barn Bluff, the two loftiest mountains in the colony, about 5100 feet. All these mountains belong to the same period as those of the centre of the island, and are either greenstone, or sandstone capped with greenstone. The plateau is very mountainous, and is cleft by deep chasms, through which issue the torrents which ultimately form the rivers of the west coast. Westward of the plateau is a second series of mountains, all of slate or conglomerate formation, which end by plunging into the Southern Ocean near South Cape. This chain is united to the first by the Eldon Range running east and west. A third series of mountains is of granite formation, and includes Mount Bischoff, Mount Ramsay, the Meredith and Heemskirk Ranges. As might be expected in such a wet mountainous country, the rivers are numerous and rapid, they run in deep gorges,

generally between high steep banks ; such a thing as a broad valley is unknown. The three principal rivers of Western Tasmania are the Arthur, Pieman, and Gordon. The Arthur cannot be entered from the sea, its bar being shallow and studded with rocks. The Pieman can be entered by vessels drawing 10 or 12 feet, but the bar is subject to tremendous seas, and is dangerous to sailing vessels. Inside the bar the Pieman is very deep, and is navigable for 18 miles. The Gordon is the finest river of the three ; it is navigable for 25 miles from the mouth at the head of Macquarie Harbour, and its source is within a few miles of the Derwent, south of Lake St. Clair ; indeed, at the great bend of the Gordon only one narrow ridge, some five miles across, separates the Gordon from the Florentine, a large tributary of the Derwent. South of Macquarie Harbour the rivers are smaller, and do not drain any wide strip of the west country. Only one, the Giblin River, can be entered by sailing vessels over 20 tons. Port Davey we may regard as a land-locked bay ; the rivers running into it are small." Large areas in the north-west portion of the island are covered with "myrtle" forest ; this myrtle is really a beech (*Fagus Cunninghamii*). In many places these trees are giving way to eucalyptus. Amongst other trees and shrubs may be specified the Huon pine (*Dacrydium*), and the King William pine (*Arthrotaxis*) ; *Eucryphia Billardieri* (along the banks of streams) ; *Richea pandanifolia* (among the granite mountains, and along Gordon River) ; and the warratah, laurel, *Agastachys*, *Pittosporum*, honeysuckle, ti tree, and the "horizontal" (*Anodopetalum biglandulosum*). Of wild animals there are kangaroos, wombat, tiger-cats (*Dasyurus*), and snakes. The principal minerals in this region are tin, gold, iron (hæmatite, siderite, magnetite, earthy ores, and chromic), wolfram, manganese, and silver lead. Besides these, antimony, bismuth, copper, cobalt, zinc, galena, and traces of nickel have been discovered.

MISCELLANEOUS.

The first portion (50 miles) of the proposed **Railway from Delagoa Bay to the South African Republic** was opened on 31st October last.

An influential society has been established called the **Alaskan Society of Sitka**, the chief objects of which are to collect and distribute information in regard to Alaska. An annual report is to be made, and scientific papers may be published from time to time in the name of the Society. It is also intended to establish a Museum at Sitka.

A St. Petersburg journal, the *Noveau Temps*, states that M. Nossilow, the explorer of the Urals, left last winter for **Nova Zembla**, where he intends to spend several years in investigating the natural riches of the island. If the results of his examination are favourable, he proposes to colonise the island with Zyranies from the shores of Petchora, and to work the mineral resources of the island.

M. Déchy has been compelled to abandon his projected tour through the **Transcaucasian region**, of which we gave notice in the September number of last year. Near the village of Adij (Svanetia) in the central Caucasus, his camp was plundered and most of his stores were stolen. Consequently, he has had to return, abandoning his contemplated journey through the district of Ararat and Kurdistan.—*Petermann's Mitt.*, Band xxx., No. 10.

General Strachey, President of the Royal Geographical Society, will shortly begin the delivery of a series of lectures at Cambridge on the scope and field of

geography. These lectures are preliminary to the establishment of a Chair of Geography at the University, and they will embody the fullest and most authoritative statement of the aims and province of the modern geographical school. They will, we are informed, be afterwards published in book form.

The *Scotsman*, in its issue of 21st January, published the following among its London correspondence :—"The adverse decision of the home Government in the matter of **The Proposed Antarctic Expedition** from Australia has excited considerable regret in colonial circles. It was pointed out by the advocates of the expedition that the home Government had an excellent opportunity of showing its willingness to co-operate with the colonies in affairs of general scientific importance at a very moderate cost to the Exchequer. The disappointment is all the more keen because some short time ago a rumour was circulated that the Treasury were inclined to look favourably on the colonial proposal, and the more eager spirits began even to discuss the question of the leadership of the expedition, which was prematurely, as it has turned out, conferred on Sir Allan Young. At the same time, it is felt that the reasons which are given in support of the decision of the home Government are not without weight, and I believe that one consideration which was present to the minds of those with whom the decision rested was that, as the proposed Expedition was avowedly nothing but a preliminary survey, by consenting to become partners in the enterprise the British Government would have committed itself to participate in the much more costly expedition which it would afterwards have become necessary to fit out. By declining to grant the £5000 asked for, the home Government, it is pointed out, has not in any way prejudged any subsequent appeal which may be made by Australia in connection with Antarctic Exploration, and, curiously enough, this is an argument which commends itself to both those who defend and to those who deplore the present action of the Government, the latter arguing that the refusal of the Treasury is based on the ground that the proposed expedition would not be sufficiently equipped to serve any useful purpose, and that therefore there is good hope of a more favourable answer to a more matured scheme, and the former pointing out that the Government by its decision has avoided pledging itself to an indefinite expenditure for very doubtful objects."

NEW BOOKS.

Geographisch-Statistisches Welt-Lexikon. Herausgegeben von EMIL METZGER. Stuttgart : Verlag von Felix .Krais, 1887-88. Vollständig in 18 Lieferungen. 50 *Pf. each Part.*

Our Honorary Corresponding Member, Herr Emil Metzger, deserves the highest praise for producing a book of such great value as his *Welt-Lexikon.* The fact that he has been able to bring out a work of such magnitude within the space of less than a twelvemonth speaks volumes for his organising talent, as well as for his industry, perseverance, and energy. Only those who have had practical experience in the management of such matters can form an adequate conception of what is implied in the preparation of such a gigantic mass of details for the press, and in their control and correction whilst they are passing through the press.

The work naturally suggests comparison with Ritter's *Geographisch-Statistisches Lexikon.* But between it and this latter the difference is much

greater than is at first sight apparent. The *Welt-Lexikon* is written especially for all who are engaged in industrial or commercial pursuits, and all those whose interests are in any way connected with industry and commerce. Being, of course, primarily intended for the use of Germans, it treats somewhat more fully of Central Europe, and the countries contiguous to Germany, than of the rest of the world. For that part of Europe it gives nearly every post-office, every railway station, and every telegraph office, and every village with 400 or more inhabitants; and it also contains most places in other parts of the world which possess either one or more of these institutions. It also makes mention of any industry carried on, or any speciality for which a place may be noted. Of the total number of separate articles—about 160,000 altogether—some 45,000 are devoted to Germany. Outside that country separate articles are given to the world's principal rivers, mountains, islands, administrative divisions, mining centres, ethnographical tribes, etc. To illustrate the treatment that countries receive, we summarise the geographical elements dealt with in the case of Spain. The principal items of information embrace the boundaries, provinces (with areas, populations, and density of the latter), physical features (including rivers and mountains, etc.), climate, natural productions, inhabitants, constitution, finance, industry, occupations, commerce, communication, instruction, religion, army, flag, measures, weights and coins, and consular service both of Spain in Germany and of Germany in Spain. It is almost superfluous to state that in all cases the latest authentic and official information has been made use of in the compilation of these facts.

This work, like all others of its class, is not exempt from the drawback that the information it conveys so soon grows out of date. The principal and almost the only objection we have to take to the work is the smallness of the type in which it is printed, making it a matter of some difficulty to read its pages. Still such a book is not intended to be read continuously—only to be consulted when occasion requires.

We are of opinion that a work exactly similar in plan and aim, but adapted to the special requirements of the British public, would supply a distinctly felt need, and we should be prepared to extend a hearty welcome to any book of this kind which should exhibit the same high qualities as Herr Metzger's *Welt-Lexikon*.

Daniel Veth's Reizen in Angola, voorafgegaan door eene Schets van zijn Leven. Bewerkt door Dr. P. J. Veth, Oud-Hoogleeraar, Eerevoorzitter van het Nederlandsch Aardrijkskundig Genootschap, en Joh. F. Snelleman, Oud-Lid der Expeditie naar Midden-Sumatra. Met platen en een kaartje. Haarlem, Tjeenk Willink, 1887. Pp. viii + 430.

This beautifully printed book is intended to serve as a posthumous monument to the life and work of Daniel David Veth, son of Professor Veth, whose work on Java is so well known, a young man who deserves to be placed in the front rank of those who have of late years sacrificed their life to the promotion of geographical exploration. Appointed one of the leaders of the Dutch expedition (1877-78) to Middle Sumatra when twenty-seven years old, he took part in the two portions of exploring work performed by that expedition, in the Padang Highlands and Palembang, respectively. Previous to this young Veth held an appointment under the Lake Zurich Railway; and after his return he did excellent service as the delegate of the Dutch Geographical Society at the Geographical Congress and Exhibition at Venice in 1881. In the following year he obtained an administrative appointment in Java, being charged at the same

time with an important commission by the executive committee of the Colonial Exhibition which was to take place at Amsterdam in 1883. In 1884 he set out for the West Coast of Africa, his principal object being to visit the Boers who have settled in Portuguese territory along the river Cunene. Unhappily, his life was sacrificed in May 1885 to the malignant climate of that region, whereby geographical science suffered a great loss.

The greater portion of this book describes with some detail young Veth's proceedings in Angola, the most interesting chapters being those in which he traces the migrations of the Boers across South Africa, from the east of the continent to the west. Besides this, it contains some useful particulars about the Mondombe people. In addition to the *Life* and the *Travels in Angola*, the present volume embraces some essays and papers written by the young explorer, dealing for the most part with the results of the Middle Sumatra Expedition. These may be regarded as in some respects perhaps the most useful part of the work.

Geography for Schools, by ALFRED HUGHES, M.A., late Scholar of Corpus Christi College, Oxford; Assistant-Master at Manchester Grammar School. Part I. Practical Geography, with Diagrams, pp. 71. Oxford: at the Clarendon Press, 1887. *Price* 2*s.* 6*d.*

This book is quite novel both in plan and execution. The title hardly suggests the contents, for "practical geography" sounds suggestive of exploration, or at least of the making of maps. Map-making is indeed referred to in the first chapter, and rules and examples are given for drawing maps on one projection; but six-sevenths of the work is occupied by mathematical geography, with the mathematics reduced to a minimum. Instead of working in the dark by means of tables of cosines and tangents, the scholar is taught how to solve approximately a number of questions in spherical trigonometry by simple geometrical constructions, and constant use of the ruler and compasses for the non-Euclidean purposes of measuring and dividing lines and angles.

There are seven chapters dealing in turn with map-drawing; measurement of distances (on Mercator courses only); time in relation to position on the earth's surface; the apparent movements of the stars, and determination of latitude; the apparent movement of the sun, and phenomena of seasons; the length of day and night, duration of twilight, place of sunrise and sunset; and a few miscellaneous exercises in calculating the length of shadows, distance seen from hill-tops, the Calendar, etc.

All the rules are stated with clearness and brevity, the methods are always simple and often ingenious; examples for exercise are added in profusion. The results are, of course, only approximate; but they have the double advantage, that the more carefully a construction is made and measured the more accurate is the answer obtained, and the end of each operation is always kept in view. Geographical exercises of this kind have been so much neglected that one is at first inclined to doubt whether a schoolboy can answer such a question as "A ship sailing from Liverpool to Buenos Ayres is wrecked on December 20. The men find their way to land in a boat. The next day they observe that the sun rises in about the ESE. At that moment one of their watches which had not been altered since leaving England showed the time 8.15. What land had they probably reached?" But Mr. Hughes shows how to do all this in a wonderfully direct and easy way. The author deserves special credit for the successful attempt to drive dryness from his pages by a skilful introduction of poetical extracts to serve as bases for calculation.

We can confidently recommend this book for use in schools, although perhaps it may not accord with the conventional conception of Geography. So original a treatment of an uninviting subject leads one to form high expectations of the remainder of Mr Hughes' "School Geography," which appears to be promised by the title-page.

There are one or two imperfections which will doubtless be corrected in the next edition, such as the omission of reference to the result of the Prime Meridian Conference on page 3; the inversion of the change in value of one degree of latitude between the equator and poles, on page 11; the confusion of the astronomical method of reckoning time with that known, unfortunately to some only, as "universal," on p. 18; and the incomplete account of the difference between old and new style in the Calendar on page 63, where no notice is taken of the change of New Year's day from 25th March to 1st January in 1752.

Pen and Pencil in Asia Minor; or, Notes from the Levant. By WILLIAM COCHRANE. Illustrated. Pp. xxiv and 464. London: Sampson Low.

The writer's personal acquaintance with "Asia Minor," so far as recorded in this volume, is confined to Smyrna and the neighbouring vilayet or province of Aidin. He also describes the sites of the Seven Churches, but it does not clearly appear that he visited them all. He touched, besides, at a few points on the Greek coast, and at one or two of the islands of the Ægean. His object in visiting Asia Minor was, he tells us, to examine its suitability as a field for emigration for Scottish farmers. He found the country, as others have done, very little developed, and with vast natural resources. The taxation is not light, but the authorities do something for the country in return, and on the whole, notwithstanding brigandage and a few other drawbacks, the writer's verdict seems favourable; but he does not go into the subject with any thoroughness. The book is, in short, throughout chatty and discursive, but not methodical, the only important chapters being those in which the writer deals, which he does fully and satisfactorily, with the processes and vicissitudes of silk-culture, which has long been one of the most valuable industries of the country.

We may add that the numerous illustrations, though occasionally somewhat coarse in execution, are as a rule both effective and artistic.

Through the West Indies. By Mrs. GRANVILLE LAYARD. London: Sampson Low, Marston, Searle, and Rivington, 1887. *Price* 2*s.* 6*d.*

This little book is brightly and pleasantly written, but contains no information that is either very new or very valuable. It records the experiences and impressions of a lady who spent a few weeks among the islands, who thoroughly enjoyed the tour, and who would now fain have others follow in her footsteps. An idle hour can be very agreeably spent over the volume, the binding, paper, and printing of which are all good and in excellent taste.

China: Its Social, Political, and Religious Life. From the French of G. EUG. SIMON. London: Sampson Low, Marston, Searle, and Rivington, 1887. *Price* 6*s.*

From beginning to end this book is one long eulogy of China and everything Chinese; one could imagine some crafty *attaché* of the Chinese Embassy tickling the ears of a credulous European with such a description—it is so ultra-Chinese. It describes China, not as it is, but as it might be, if its really admirable laws were ever justly administered. Some of the statements are so utterly absurd that one is constrained to believe that, if the author ever was in China, he must have made very little use of his opportunities for learning anything about the country.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

A CRITICISM OF THE THEORY OF SUBSIDENCE AS AFFECTING CORAL REEFS.

(*With Maps.*)

By H. B. Guppy, M.B.

Part I.

I have not hitherto published any opinion on the general position of Mr. Darwin's theory of coral reefs, from an unwillingness to do more than describe the bearing of my own observations in the Solomon Islands. The fact of having spent some months in the examination of a region of coral reefs, may, however, give me some claim to speak on the present aspect of the question of reef formation, especially as during the last five years I have repeatedly gone over the evidence advanced on both sides of the controversy. The object of the present paper is to show that the inferences of Mr. Darwin were valid as far as his evidence went, but that, on account of the great increase in our knowledge of coral reefs and of the ocean depths during the period of nearly half a century that has elapsed since he wrote his work, the earlier evidence is now seen to be very defective, and often erroneous.

It is, in the first place, important to notice, as his recently published biography informs us, that the idea of subsidence, as affecting the great ocean basins, had been firmly impressed on the mind of the young naturalist of the *Beagle* before ever he saw a coral reef, and was an idea which had forced itself upon his attention as a result of his geological observations in South America. Thus he was led to hail with satisfaction the support apparently given to his views of the ocean basins by the coral reefs of the Pacific and Indian Oceans.

We all know how Mr. Darwin demonstrated the necessity of a movement of subsidence to explain the phenomena of coral reefs, *as they were*

then known. It was the limited depths of the reef-coral zone that led him to consider the nature of the foundations on which the great oceanic groups of atolls were based. After he had rightly rejected the crater hypothesis, two explanations suggested themselves to his mind : the first, that they were based on banks of sediment ; the second, that each atoll had a rocky foundation. These are the only two possible explanations, and it is here that we have the parting of the ways in the present controversy. The first explanation Mr. Darwin at once dismissed with the remark that "the assumption, without any proof, that a number of immense piles of sediment have been heaped on the floor of the great Pacific and Indian Oceans, in their central parts, far remote from land, and where the dark-blue colour of the limpid water bespeaks its purity, cannot for a moment be admitted."[1]

Now it is of considerable importance to notice at the outset that the explanation which Mr. Darwin very justly rejected from want of evidence nearly half a century ago is the one which all recent discoveries and researches have gone to support. The great facts concerning pelagic life and the deep-sea deposits, which have been established by the Challenger Expedition, proved the correctness of the assumption, which was without proof when Mr. Darwin wrote. Mr. Murray has estimated that the organisms actually existing in every square mile of the tropical ocean, down to a hundred fathoms, contain over sixteen tons of carbonate of lime. In the shallower depths, for instance, on the summits of submarine elevations, a calcareous deposit is forming from the remains of the foraminifera, pteropods, heteropods, calcareous algæ, and other organisms that crowd the surface waters. In the course of time sponges, hydroids, deep-sea corals, annelids, alcyonarians, molluscs, polyzoa, echinoderms, etc., form a rapidly increasing deposit on the bank, and raise it to the level suitable for the growth of reef-corals.[2] The same conclusion was subsequently arrived at by Professor A. Agassiz in the case of the Florida reefs ; and my discoveries in the Solomon Islands have shown that underneath the upraised atolls and barrier-reefs there lie the consolidated pteropod and foraminiferous oozes of the Challenger Expedition, and that these deposits overlie old volcanic peaks. In another way we now know that Mr. Darwin was misled by the very imperfect knowledge then possessed of the ocean depths. Oceanic shoals are far more numerous than ever he was led to suspect. By the rapid method of sounding employed in laying the telegraph cables, the list of known oceanic shoals has been very greatly increased ; and Mr. Buchanan, who has examined shoals thus discovered in the East Atlantic, has arrived at the conclusion that the deep-sea corals which grow luxuriantly on their summits, form by their upward growth lofty vertical masses which in the tropics would ultimately afford a foundation for the growth of reef-corals.[3] It is remarkable that Professor Semper found in some of the coral cliffs of the Pelew

[1] *Coral Reefs*, p. 92 ; 1842. [2] *Proc. Edin. Roy. Soc.*, 1879-80. [3] *Ibid.* 1885-86.

Islands a structure similar to that suggested by Mr. Buchanan. The base was formed entirely of deep-sea forms of corals, whilst the higher portion contained the usual reef-building corals of those seas.[1] We thus see that there is evidence, both direct and indirect, that, as contended by Mr. Murray, atolls are based on banks of organic deposits formed in the open sea. In fact, all recent observations point in this direction.

Mr. Darwin naturally dismissed the explanation that atolls could be based on submarine banks, because what was then known of the deep seas gave no countenance to such a view. He therefore turned to the second explanation, that the many widely scattered atolls rest on rocky foundations. Here he was at once met by the difficulty of imagining that throughout the great areas occupied by the larger groups of atolls, so many submarine mountains should rise up to just within the zone of reef-corals, and never above it. So highly improbable seemed this supposition that he was compelled to consider that the rocky bases of such coral reefs had been brought to the requisite level by movements of the earth's crust. The movement of elevation he summarily dismissed, because in some of the great groups of atolls not a single point of the rocky foundation had been observed, and for similar reasons he rejected the idea that the protruding tops of submarine mountains might have been worn down by breaker-action. His exclusive method of reasoning drove him to the conclusion that since the foundations of atolls could not have been uplifted into the requisite position, they must necessarily have subsided into it. Hence arose his theory of subsidence, for which, as already observed, his mind was previously prepared.

To-day, with our increased knowledge of nearly fifty years, we cannot dismiss this first explanation considered improbable by Darwin. On this step the more recent accessions of facts compel us to halt, and there is no need to pass beyond. The necessity of the explanation of subsidence has disappeared, and with it the foundation of Mr. Darwin's hypothesis.

I now proceed to inquire how it was that the originator of this theory found his views accord so well with the knowledge then possessed of coral reefs. The facts given in his work are sometimes advanced as if they were the basis of the theory, which is something like asserting that the superstructure of a house is its foundation. It was the limited depth of the reef-coral zone, and the apparent necessity of finding a rocky basis for the large oceanic groups of atolls, that led Mr. Darwin to the explanation by subsidence. The facts he subsequently collected, at the cost of much labour, from almost every voyage, chart, and geographical memoir that referred to regions of coral reefs, and from the observations of the few naturalists who had preceded him; yet, it may be truly said that his work on coral reefs did not give rise to his theory, but only supported it. How was it then that the facts impartially recorded in this work were so well explained by the theory of subsidence?

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[1] *The Natural Conditions of Animal Life*, vol. xxxi., Internat. Scient. Ser. p. 275.

The reason is that the test-regions by which alone the truth of the theory could be proved or disproved, namely, those of upraised coral reefs, and of the ocean depths, had been in Mr. Darwin's time but little explored. They did not come prominently under the notice of Professor Dana, whose extensive experience of coral reefs practically established this brilliant explanation. The result of the imperfect acquaintance with regions that would afford crucial evidence has been very disastrous to the theory. Every now and then during the past quarter of a century there have risen up observers, who, from different parts of the world, and on widely different grounds, have lifted their voices against the explanation of subsidence; and it is worthy of remark that the regions from which their voices came were those about which Mr. Darwin possessed defective, and often erroneous, information.

From the Florida reefs, from the Bermuda atoll, from the distant Pelew Islands, from the reefs of Tahiti, and from the previously little-known ocean depths, weighty objections against the theory of subsidence have been advanced by A. Agassiz, Rein, Semper, and Murray, whilst the most recent adverse testimony has been afforded by my own discoveries among the upraised coral islands of the Solomon group. Even the supporters of Darwin's view had unwittingly supplied arguments to their opponents. Dana, though the great advocate of the theory of subsidence, admitted that small elevations have taken place in all parts of the Pacific,[1] whilst Couthouy[2] and Beete Jukes,[3] when many years ago they announced their adherence to the explanation of Darwin in the instances of the Low Archipelago, and of the Australian barrier-reef, recorded that the only direct evidence they had found, pointed to upheaval.

Reference may now be made to the sources from which Mr. Darwin obtained his information, and to the materials from which he constructed his map of the distribution of coral reefs. Those who have spent much time in overhauling old nautical memoirs, and the accounts and charts of the early Pacific voyages, will readily understand that the danger of error is frequently great. The necessarily defective sources of his information led the author of the theory of subsidence into several errors concerning the distribution of reefs.

My criticisms are chiefly confined to the coloured map of the Pacific reefs, and the first edition of the work, published in 1842, is selected because I intend to impugn the accuracy of the facts that originally established the theory of subsidence.

The Fiji Islands are coloured blue, as indicating their situation in an area of subsidence. It has since been ascertained that all the three classes of reefs exist in this group, and that the Lau or Windward Islands

[1] *Corals and Coral Islands* (1872), p. 346.

[2] *Remarks on Coral Formations* (Boston, 1842). Mr. Couthouy, though strongly advocating the theory of subsidence, gives his "reasons for believing that the whole of Polynesia is at present slowly rising."

[3] *Voyage of H.M.S. Fly*, ch. xiii. (1847).

possess elevated reefs sometimes removed 600 feet above the sea;[1] whilst very recently we have learned of the occurrence of a deposit at Suva, which, from the character of its foraminifera, affords evidence of an upheaval in Post-Tertiary times of from 1000 to 1200 feet.[2] We cannot doubt that if these facts had been known to Mr. Darwin, he would never have placed the Fiji Islands in an area of subsidence.

The Low Archipelago, a large group of more than eighty atolls, forms one of the most conspicuous of the blue areas of subsidence in the coloured map. At the time he wrote, Mr. Darwin was aware of the opinion of Mr. Couthouy, that the whole group had been elevated a few feet, but he did not regard it as well founded. Professor Dana, however, has since shown that there are evidences of elevation in widely separated parts of the group, the greatest indicating an upheaval of 250 feet; but he strangely remarks that these are no evidences of a general elevation, and do not affect the application of the theory of subsidence. I shall subsequently point out, when treating generally of the evidences of elevation scattered all over the Pacific, that these signs of upheaval in the Low Archipelago are part of a general movement. For the present, therefore, I will content myself with remarking that to explain the existing condition of this archipelago of atolls, we need not employ a movement of subsidence in the teeth of evidence directly indicating elevation.

The next instance is that of the Pelew group. Mr. Darwin places these islands in an area of subsidence; but at the time he prepared his map they were imperfectly known. The result has been that subsequent observations have not supported his views. In 1863 Professor Semper published the results of his examination of the group, when he pointed out (*a*) that all varieties of coral reefs are to be found there; (*b*) that living atolls co-exist with ancient reef-masses elevated 250 to 300 feet above the sea; (*c*) that many other features of the reefs are not to be explained by the theory of subsidence. Professor Semper therefore concluded that this group is situated in an area of elevation; but Mr. Darwin, in the second edition of his work on Coral Reefs, published in 1874, retained his previous opinion. When, however, Professor Semper was preparing his revised account of these islands in 1879, he submitted the proof-sheets to Mr. Darwin, who observed, in his reply, that although he still adhered to his theory, yet he admitted that such cases as that of the Pelew Islands, if of at all frequent occurrence, would make his conclusions of very little value. "Future observers,"—thus he continued—"must decide between us."[3] Before leaving this subject of the Pelew Islands, I should remark that the objections here raised by Professor Semper will in all probability be found to apply to the adjacent Caroline Archi-

[1] *Sailing Directions for Fiji* (Hydrographic Office, 1882).

[2] *Vide* "Note on the Suva Soapstone, so called," by H. B. Brady, Geolog. Soc., Nov. 9th, 1887.

[3] Semper's *Natural Conditions of Animal Life*, vol. xxxi. Internat. Scient. Ser. p. 456. This work contains the views of this naturalist concerning coral reefs.

pelago, to which the Pelew group geographically belongs. This large region of atolls and barrier-reefs is but imperfectly known to the geologist, and was placed by Darwin in an area of subsidence.

The foregoing are some of the more conspicuous examples of error concerning the Pacific regions of subsidence. There are, however, one or two other difficulties which have suggested themselves. For instance, Mr. Beete Jukes, when, about forty years ago, he examined the Australian barrier-reef, came to the conclusion that it had "either been slightly elevated, or at least had not suffered any depression during a long period of time;" yet, he inconsistently considered the explanation of subsidence as giving a perfectly satisfactory account of the formation of the reef.

There are cases in which Mr. Darwin and Professor Dana did not agree as to whether the evidence should be regarded as indicating elevation or subsidence. Amongst these may be mentioned that of the Samoan Islands. This large group is placed by Mr. Darwin in an area of elevation. Professor Dana, however, states that the facts known are against any elevation; and he has estimated the subsidence in some of his writings at one or two hundred feet. The Fanning group is indicated in the map as situated in a subsiding area. Professor Dana, on the other hand, speaks of two of the islands of this small group of atolls as having experienced a small upheaval. The island of Rotumah is another instance. Mr. Darwin first considered it as seated in a subsiding area. Other evidence led him to colour it red, as lying in a region of upheaval. Professor Dana, however, inclines to the first opinion, since he speaks of its possessing encircling reefs.

We now come to the large archipelagoes of the Western Pacific, which afford powerful testimony of the necessarily imperfect character of the materials from which Mr. Darwin constructed his map of the distribution of coral reefs. In the first place, I may take the Solomon Islands, with which I am more particularly acquainted. From the scanty materials at his disposal, Mr. Darwin concluded that this large group is solely characterised by fringing-reefs, and he placed it in his map in an area of upheaval. In so far as this group is situated in an area of upheaval, he was perfectly right; but, unfortunately for his theory, extensive barrier-reefs, and even atolls, are also found, a circumstance directly controverting his views, which ascribe the formation of these two classes of coral reefs to a subsiding movement. In addition to the living barrier-reefs and atolls, there have been found in these islands reefs of the same description, which have been elevated in some instances several hundred feet above the sea; and the important point is, that these upraised barrier-reefs and atolls have their foundations exposed, and that their thickness of from 100 to 200 feet is no greater than we should expect in the case of reefs which have experienced no subsidence during their growth.[1] Mr. Darwin, when writing his work, lamented that the upraised coral islands

[1] *Geology of the Solomon Islands* (1887), chap. v.

of the Pacific had not been examined by a geologist.[1] So far as they have been examined since, they have given no support to his views; the Solomon Islands stand foremost among the silent witnesses against them; and it is a matter for deep regret to the writer of this paper that his facts and observations never came before the author of the theory of subsidence.

Here, in an area of long continued and very extensive upheaval, where we find amongst the terrestrial formations marine deposits formed originally in depths of from 1000 to 2000 fathoms, in such a region as this are to be found living barrier-reefs and atolls, associated with upraised reefs of the same character which have only the thickness of the reef-coral zone. When Mr. Darwin's work was published, our information of this group was most imperfect and often erroneous; and as an instance of how he may have been frequently misled in consulting the early charts of the Pacific, a case referring to these islands may be cited. Amongst the scanty data which he collected concerning this group was a note he made, that, according to Bougainville's chart of Choiseul Bay, fringing-reefs occur there; and this was one of the facts on which he founded his inference that fringing-reefs solely characterise these islands. Choiseul Bay, which was recently surveyed by Lieutenant Oldham and the officers of H.M.S. *Lark*, has proved to be enclosed by a line of barrier-reef.

Amongst other instances of error in the Western Pacific, is that relating to the New Hebrides, a group which, little as it was known in 1842, is still very imperfectly surveyed. These islands do not possess the extensive reefs that characterise the neighbouring groups. From the charts he consulted, Mr. Darwin concluded that they have no encircling or barrier-reefs, and he coloured them red as indicative of a region of fringing-reefs. We now know that barrier-reefs skirt the east side of the large island of Mallicolo;[2] and in all probability, when we have a better knowledge of these islands, further instances of this class of reefs will be found. Forming the northern end of this archipelago, we find the Banks Islands, where the Rowo Reef, a remarkable crescent-shaped atoll, occurs, and the encircling reef of the island of Santa Maria. The Banks Islands are not coloured in his map of coral reefs; but it is evident from his remarks that Mr. Darwin considered them as solely characterised by fringing-reefs. Before leaving the subject of the New Hebrides group, I should allude to the circumstance that an observation made by the late Commodore Goodenough, renders it very probable that here, as in the Solomon Islands, there exist upraised deep-water deposits.

As the last instance I will take the case of New Ireland, which, contrary to the expectation of the author of the subsidence theory, we now know possesses a barrier-reef on its west side. A kind of modern chalk, out of which the New Ireland images are carved, has been shown by Mr. H. B. Brady to be a comparatively deep-sea deposit, a circumstance

[1] *Coral Reefs* (1842), p. 73.

[2] The latest information of this group is to be found in the Admiralty charts, and in *The Sailing Directions for the Pacific Islands*, vol. i. (1885).

pointing to the very extensive upheaval of this region during Post-Tertiary times.

The errors above noticed have come under my observation without any systematic examination of the whole of the evidence at the disposal of Mr. Darwin. They are, however, sufficient to show that in his map of the distribution of the Pacific reefs he was led by imperfect information to make many erroneous statements. A more complete examination of the only two large groups of atolls I have not referred to, namely, the Marshall and Gilbert Islands, will bring to light opposing facts of which the author of this theory was ignorant. I have probably now gone far enough to prove that Mr. Darwin's map of the distribution of Pacific reefs is of little value in support of his theory.

It cannot be said that the advocacy of its supporters has always strengthened the position of this theory. Amongst other matters, Professor Dana differed from Mr. Darwin in respect to fringing-reefs, which were regarded by the latter as indicating regions of non-subsidence or elevation. The American naturalist pointed out that these reefs afford no certain evidence of a stationary level, and that often, especially when skirting bold shores, they afford evidence of a greater subsidence than is implied by barrier-reefs.[1] Such a conclusion, as Professor Semper[2] remarks, at once destroys the value of the testimony afforded by coral reefs of the movements of the earth's crust. If all kinds of reefs can be formed during subsidence, it follows that the character of a reef cannot guide us in determining the existence of subsidence or upheaval; yet it was on the characters of the reefs that Mr. Darwin founded his areas of depression and elevation in the Pacific and Indian Oceans. Professor Dana argues that the theory of subsidence is supported on other grounds. That may be so, but it is quite apart from the question at issue, namely, whether it is supported by the facts at present known concerning coral reefs.

"Out of thine own mouth will I judge thee," are words which may be correctly employed in the case of some of the evidence advanced by the adherents of the theory of subsidence. In Professor Dana's *Corals and Coral Islands*, published in 1872, there is a lengthy list of the elevations in the Pacific Ocean, and the conclusion arrived at by the author was, "that these elevations have taken place in all parts of this ocean." If we except the Marshall and the Ellice groups, every region of atolls and barrier-reefs is represented in his list of upheavals; but notwithstanding this admission, Professor Dana regarded the theory of subsidence as in no way endangered. Such elevations, he says, are local and unequal, and afford no testimony in support of a general rise; and he especially takes the case of the Low Archipelago, where, amidst a great number of living atolls, there are a few others that have been upraised to heights of varying degree above the sea. I contend that these elevated atolls represent a general movement of upheaval, which has been interrupted by a long

[1] *Amer. Journ. Sci. and Art*, 3rd Ser., vol. viii. p. 316.
[2] *Animal Life*, vol. xxxi., *Internat. Scient. Ser.* p. 231.

interval of rest extending to our own time. The explanation of Mr. Murray will give a satisfactory account of the formation of these islands, without calling to its aid a subsiding movement of which there is no evidence. The general movement of upheaval was only sufficient to cause the protrusion above the surface of the ocean of the highest peaks of the volcanic mountains that underlie the atolls of the Low Archipelago, the protruding peaks being capped by the atolls now raised above the sea. Since Professor Dana and Mr. Darwin both agree that this large group has experienced no change of level during a long period—and of this there seems to be no doubt—there will have been sufficient time for many of the submerged peaks to be levelled up to the reef-coral zone by organic deposits, and the growth of deep-sea corals, whilst most of the protruding points of volcanic rock were being worn down by breaker-action, so as ultimately to form foundations for other atolls. Mr. Murray's theory is quite competent to explain the present condition of this archipelago, so that it is unnecessary to dwell any longer on this matter.

I have long been unable to understand how the earlier observers of the Pacific reefs—Dana, Couthouy, and Beete Jukes—became so enamoured of the theory of subsidence, when the only direct proofs they could find of any movement in the regions they visited were those of elevation. I say *direct* proofs, because I do not regard the coast configuration of an island, or the characters of the seaward slopes of reefs, or the arrangement of islets, or the depths of lagoons, or many of the other points so often referred to, as affording in our present state of knowledge direct evidence of any movement whatever. Their testimony is always indirect, and is frequently appropriated by both sides in this controversy.

Some of the most important pieces of evidence put forward on behalf of subsidence have hinged on facts which have been misinterpreted, or imperfectly observed. Thus, I have already shown in another paper, that the statements that lagoons and lagoon-channels are sometimes deeper than the zone in which reef-corals thrive, is founded on a misconception of the conditions that limit the depth of this zone. I have there pointed out with some detail, that whilst local conditions usually restrict the reef-coral zone to depths less than 30 fathoms, reef-corals may under favourable conditions occasionally thrive in depths of 50 and 60 fathoms. For the data on which this conclusion is founded I must refer those interested to the original paper on the Coral Reefs of the Solomon Islands.[1] It will be sufficient here to state that we can explain the apparently abnormal depths inside some atolls and barrier-reefs without calling in a movement of subsidence. In thus doing, we dispose of one of the principal points urged on behalf of Mr. Darwin's theory of coral reefs.

Did the matter rest here, we should be compelled to admit that the theory of subsidence was in grave danger, but not absolutely disproved. Final judgment would be withheld until we could examine the structure

[1] *Proc. Roy. Soc. Edin.*, 1885-86.

of an upraised atoll or barrier-reef. This is the testimony that would be lacking, and thus Professor Dana, when writing in 1885, in reply to Mr. Murray, refers to "borings in coral islands" as "the true means of investigation."[1] At that time, Professor Dana was only acquainted with a bare announcement of my discoveries in the Solomon Islands, and he rightly dismissed them in a somewhat cursory manner. He has since, however, had all my observations before him, and there he will doubtless find that in this region we have natural sections of upraised coral islands, which are of far greater value than any artificial borings in existing reefs. The thickness of the upraised atolls and barrier-reefs of this region corresponds with the depth of the reef-coral zone; and beneath them occur foraminiferous and pteropod muds. We see here that atolls and barrier-reefs can be formed without subsidence; and, so far as the structure of elevated reefs is at present known, we find no confirmation whatever of Mr. Darwin's views.

In conclusion, it should be pointed out that in the consideration of this question we have recently passed from the *à priori* to the inductive method. Professor Dana, in his last paper of 1885, contends that the theory of subsidence shaped itself from the facts presented to Mr. Darwin; but we have already shown that the idea of subsidence in the ocean basins was firmly impressed in the mind of the originator of the theory before ever he saw a coral reef. The object of this controversy is, however, not to decide whether Mr. Darwin is correct or whether Mr. Murray is correct, but to establish our right to follow the lead of facts without hampering ourselves with an hypothesis, which, as recent observations teach us, we have the gravest reasons to suspect. I ask those interested in this matter to weigh the evidence for themselves, and especially to avoid being led by any dictum of authority into prejudging the case.

It cannot even be allowed that this theory has been of any real utility in advancing our knowledge of coral reefs. On the contrary, I contend that it has checked our progress in this respect. Careful and repeated examination of the literature on the subject has convinced me that this theory warped and misdirected the observing powers of its early supporters, and that it did so to such an extent, that more recent observers, following their guidance, have been placed under a great disadvantage in studying the phenomena of coral reefs. The confidence engendered by it in some degree blinded the first adherents of this view; and the later workers in consequence occupied much of their time in removing the obstacles the theory presented, before they had a free path of observation laid out. In the early part of my sojourn in the Solomon Islands, this view threw so much dust in my eyes that many critical points quite escaped attention. It was only in the second year, having freed myself from my preconceptions, that I realised how much had been passed over in localities which I could never revisit.

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[1] *Amer. Jour. of Science*, Sept. 1885, vol. xxx.

It would appear that the attitude of future investigators in this field should consist in warily following the facts. There are no persons who look forward with greater confidence to the further detailed examination of coral-reef regions than the supporters of Mr. Murray's chemico-biological theory. For them, the coral reefs of the Pacific have to be to a great extent re-examined, but without the doubtful light cast upon them by an hypothesis we cannot trust. They consider that the problem requires for its solution far more of careful and prolonged observation than it has hitherto received, and that the theory of subsidence, based as it was originally on defective data, and unsupported as it is by recent researches, should no longer be allowed to bias, as it has done so often in the past, the observations of the future inquirer.

Part II.

A Comparison of Mr. Darwin's Original Map of the Distribution of Coral Reefs in the Pacific Ocean, published in 1842, with a Map showing their Distribution as known in 1888.

It will be first necessary to make a few remarks on the colouring of these maps. In the older map *red* indicates fringing-reefs; *violet*, barrier-reefs; and *dark blue*, atolls; and Mr. Darwin endeavours to establish the fact that the areas of fringing-reefs are either rising or stationary, whilst those of atolls and barrier-reefs are subsiding. Unfortunately, as Professor Dana[1] has pointed out, fringing-reefs are often associated with barrier-reefs in the same group and even in the same island, and they are, therefore, of no value in marking out the stationary or rising areas from those subsiding, seeing that they occur frequently in the areas of assumed subsidence. Later investigations have shown us that in almost all the principal regions coloured red in the map of 1842 (the Samoan and Tongan groups, the New Hebrides and the Solomon groups, and the Ladrones) barrier-reefs, and often atolls, also occur. The recent map has been coloured by me on a somewhat similar plan—the red indicating areas of upheaval as evidenced by upraised reefs and other organic remains, the violet distinguishing the barrier-reefs, and the dark blue circles the atolls. Atolls which have been upheaved are coloured red inside the blue. The amount of upheaval, as shown by the red figures, is also given; but the estimates are only provisional, and err on the side of caution.

I will direct my remarks to the following propositions, the establishment of any one of which would seriously affect the theory of subsidence.

(1.) The necessarily defective data and erroneous information from which the map of 1842 was constructed.

(2.) The universal distribution of atolls and barrier-reefs in the Pacific.

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[1] *Corals and Coral Islands*, 1875, pp. 103-105.

(3.) The general character of the movement of upheaval in all coral-reef regions of the Pacific.

(4.) The presence of active volcanoes in regions of atolls and barrier-reefs.

(1.) *The necessarily defective data and erroneous information, etc.*—In the first part of my paper some of the more conspicuous instances of error are referred to. I propose here to give a few more instances.

The Tongan Islands are coloured red by Mr. Darwin, as implying that they lie in an area of upheaval, and possess no living barrier-reefs and atolls. The upraised coral islands of this group sufficiently establish the fact of upheaval; but the absence of living barrier-reefs and atolls is negatived by our increased knowledge of these islands, with which even now we are most imperfectly acquainted. Off the north side of the upraised atoll of Tongatabu there is a large crescentic reef of the atoll class. Many of the low Hapai Islands lie on an extensive reef of the same character which has been slightly elevated. Away to the east of Namuka, itself an elevated atoll, we have a broad barrier-like line of reef. Off the windward side of Vavao occurs a broken barrier-reef; whilst amongst the numerous little-known shoals in and around the Tongan group some have the atoll form. Here, then, in an area of upheaval, we have upraised atolls, and probably barrier-reefs, accompanied by living reefs of the same description, with the existence of which the author of the theory of subsidence was not acquainted. Mr. Darwin records evidence of upheaval in these islands to the extent of 200 or 300 feet, and he refers to two upraised atolls, one of which, Tongatabu, has been raised some 60 feet, and the other, Namuka, about 20 feet. With this evidence of upheaval before and after the formation of these atolls, we look with great suspicion on a theory that intercalates a period of subsidence, of which it possesses not a single proof.

The Samoan Islands afford another instance of imperfect information. They are coloured red, as indicating the presence only of fringing-reefs. We now know that Rose Island, at the east end of the group, is an atoll; and that off the eastern shores of the large island of Savaii there is a barrier-reef, with passages inside the reef for coasters of 30 or 40 tons. On the north side of Upolu there is a wide fringing-reef which, at some parts of the coast, as off Saluafata, takes the characters of a barrier-reef. With these facts before him, Mr. Darwin would never have coloured this group as solely possessing fringing-reefs.

There are a few conspicuous errors in the map of 1842, referring to the Hervey, Austral, and Society Islands, which, though they do not invalidate the theory, exemplify the faulty information on which it was based. Rarotonga, for instance, was coloured red as not possessing a barrier-reef. We now know that it is surrounded by a barrier-reef.

The Caroline Islands, as far as they were known nearly half-a-century ago, seemed to give great support to the theory of subsidence. We are still very imperfectly acquainted with this large group of coral islands; but the more recent additions to our knowledge tend to controvert this view. Here, as Mr. Darwin pointed out, was a characteristic subsiding area as indicated by the number of atolls, and to a less extent of barrier-

reefs. Only one point of upheaval seemed to break into this extensive region of uniform subsidence. Away towards the western end of the group lay the upraised atoll of Fais or Tromelin Island, which indicated an upheaval of 90 feet, or, as later information more correctly gives it, 30 feet. This sudden upheaval, in an area of assumed subsidence, Mr. Darwin explained by viewing the island of Fais as evidencing a prolongation of a line of upheaval southward from the neighbouring Ladrones. We know now, however, scanty though our knowledge of these islands still is, that there are not only other upraised atolls, but that there are islands which, with our facts before him, Mr. Darwin would have coloured red instead of regarding them as surrounded by barrier-reefs. At the eastern end of the group occurs the upraised atoll of Pingelap, 60 feet in height, and the adjacent island of Mokil appears to possess the same characters; whilst the neighbouring volcanic island of Ualan possesses broad fringing-reefs, and not a barrier-reef as indicated in the old map. In the middle of the Caroline Islands are several little-known coral islands of small size, resembling Fais Island in having no lagoons and in other features; such islands have probably experienced some upheaval. Again, Yap Island has a fringing rather than a barrier-reef as indicated in the early map. Ponapi is an island surrounded by a barrier-reef according to the map of 1842. The latest chart, however, gives no indication of an inside channel, and shows the anchorages to be merely breaks in the reef.

In this island of Ponapi we have adduced by Prof. Dana and Mr. Darwin direct evidence of a subsidence still in progress, as exhibited by the present partly-submerged condition of the sacred stone ruins of Tamen. Though it is not material to my purpose to dispute this point, since the question before us is not whether there is subsidence in the ocean basins, but whether such a movement is necessary to explain the growth of coral reefs, still I will take this opportunity of remarking that in some incomprehensible way both Prof. Dana and Mr. Darwin (in his last edition of 1874) have overlooked the testimony of a competent observer, who, as a resident on the island, formed a very different opinion concerning the inference to be drawn from the present situation of these ruins. Dr. Gulick, to whom I allude, has the advantage of telling his own story; whilst the information of Prof. Dana and Mr. Darwin is neither the result of their own observation nor even of that of their immediate informants, and does not bear the same stamp of authority. After inspecting the locality, Dr. Gulick emphatically states that these ruins occupy their original position, and that the habits of the people would lead them to select such a situation for the ingress and egress of their canoes. Though accepting the theory of subsidence, this observer was unable to regard such evidence as in any way supporting it.[1]

By comparing the old and the recent maps, it will be noticed that we have enlarged our acquaintance with the coral reefs lying to the westward of the Sandwich Islands. We are now aware that there exists in this part of the North Pacific a submarine chain of mountains of great length, of which the easternmost portion projects above the surface of the ocean

[1] Extract from Dr. Gulick's paper on Ponapi, taken from Silliman's *Journal of Science*, and given in Rosser's *North Pacific Pilot* (1870), p. 210.

in the form of the present volcanic islands of the Sandwich group, whilst the western portion is represented at the surface by a long line of atolls and coral shoals. The upheaval, of which we find evidence in the uplifted reefs of the volcanic islands, is also represented, but to a much less extent, in the atolls of the western part of the chain. Here we have, writes Mr. Darwin in his edition of 1874, elevation at one end and subsidence at the other. Again we ask the question, Where in this locality is the proof of subsidence? Once more we find that the proof of the existence of such a movement rests on an assumption.

It will be also observed on comparing the two maps, that, besides many other additions, several new oceanic atolls are shown in the recent map. I will, however, only refer in conclusion to the instance of the Loyalty Islands, of which Mr. Darwin knew little or nothing. They represent a line of upheaval parallel to the trend of the neighbouring large island of New Caledonia, and lying 45 to 50 miles distant; and they afford an instructive example of the upheaval of a line of atolls. To the northward we have the living atoll, known as the Astrolabe Reefs. South of this lies Halgan or Uea Island, which, as we learn from the recent charts and descriptions of this group, is evidently the windward border of an atoll, raised some 60 feet above the sea; whilst living reefs close in the rest of the basin, which is said to be at least 15 miles across and about 10 fathoms deep. The neighbouring low Beaupré Islands appear to rise from a smaller atoll. South of Halgan is the island of Lifu or Lafu. It is also of coral formation rising to an average height of 120 feet, but attaining at points on its eastern or *weather side*, an elevation of 250 feet. On its N.W. side there is a deep bay 12 miles in width. In this island, therefore, we have an uplifted atoll which represents a much later stage of upheaval than that shown in the instance of Halgan Island. Next to Lifu, is the island of Maré, also of upheaved coral formations. It is most elevated on its S.E. or weather border and apparently slopes away towards its western margin, where lies a lagoon-like bay possessing regular soundings and partly shut in by a margin of living reefs and small islands. In this island of Maré we have without doubt an upraised atoll, but in a stage intermediate between those exhibited by Halgan and Lifu. The Loyalty Islands, therefore, present us with a group of large atolls, 15 to 30 miles across, which have been raised in recent times to heights ranging up to at least 250 feet above the sea. The destructive agencies of denudation, both subaërial and marine, have done much to alter the contours and profiles of the older islands of Lifu and Maré; but Halgan presents us with an earlier and much more recognisable stage of the upheaval; whilst away some forty miles to the northward we have the living atoll exhibited in the instance of the Astrolabe Reefs. One broad fact at least we can extract from the remarks just made. Here may be found, situated along the same line of upheaval, the living atoll, the partly upraised atoll, and the completely upraised atoll.

(2.) I now pass on to the second proposition which I intend to establish, viz., the universal distribution of atolls and barrier-reefs. A perusal of the recent map will render it evident that atolls and barrier-reefs occur all over the coral region of the Pacific independently of any movement

of upheaval or subsidence. The atoll is the reef of the open sea; whilst around the volcanic islands we find fringing-reefs and barrier-reefs, *the first characterising rapid submarine slopes, the latter forming on slopes of a gentle inclination.* Excluding the Sandwich Islands, there is not a single group of volcanic islands in the Pacific that does not possess living barrier-reefs. The Society Islands; the Austral Islands; the Hervey group, with its elevated atolls; the Samoan group, with its evidence of upheaval in Manua Island; the Fiji Islands, with their upraised reefs; the Ladrones; and last, but most important of all, the great groups of the Western Pacific, lying in a region of very extensive upheaval (New Britain, New Ireland, the Solomon, Santa Cruz, and New Hebrides groups)—all these islands are characterised to a greater or less degree by barrier-reefs. Here also we should allude to the great barrier-reefs of Australia, south-east New Guinea, the Louisiades, and New Caledonia.

(3.) The next proposition is that relating to the general character of the movement of upheaval in the coral-reef regions of the Pacific. I need scarcely dwell on this point, inasmuch as Professor Dana himself allows that elevation has taken place in all parts of this ocean, and he gives a long list of localities thus upheaved, together with the amount of upheaval. With the assistance of his list of elevations, and aided by data derived from other sources indicated at the close of this paper, I have been able to mark in red figures in the recent map the amount of upheaval of which we have hitherto found evidence in the Pacific Islands. Our information, however, on this subject is of the scantiest description. Yet, it is sufficient to show that, with the exception of the Marshall Islands, which have yet their story to unfold to the naturalist, all Pacific groups, whether composed of lofty volcanic islands or of low-lying atolls, have been affected by this movement. In short, we find no evidence of the alternate regions of subsidence and elevation indicated in Mr. Darwin's map. Our present evidence leads us to infer that the greatest upheaval has taken place in the Western Pacific. Since, however, the Fiji Islands have disclosed to a recent investigator evidence of considerable recent upheaval, we may regard it as not improbable that further eastward, toward the centre of the Pacific, other island groups little known to the geologist will yield similar testimony. The oft-told tale of the occurrence of upraised recent organic remains in the Society group has been usually discredited but never disproved. At present, nevertheless, we must refrain, on account of our most imperfect knowledge of the geology of the central Pacific islands, from forming any conclusion on the subject of the nature and extent of this movement of upheaval. There is one inference, however, which recent facts and observations enable us to draw, namely, that upheaval in no way affects the distribution of coral reefs except in so far as the emergence of lofty islands determines the occurrence of barrier- and fringing-reefs, whilst atolls are for the most part confined to the open sea.

(4.) The last proposition is the most important of all; and in establishing the fact of the presence of active volcanoes in regions of barrier-reefs and atolls, I shall be removing one of the principal standpoints of the theory of subsidence. Amongst the most striking generali-

sations, to which Mr. Darwin was led by his facts in 1842, was that which restricted active volcanoes to rising areas and banished them from regions of subsidence. Two conclusions, one valid and the other founded on faulty premises, or rather on insufficient data, led Mr. Darwin to detect this remarkable fact in the distribution of active volcanoes. The first was the well-founded conclusion, that in regions of volcanic activity upraised organic remains of modern date are usually found. The second was the imperfectly established inference that atolls and barrier-reefs do not characterise such regions of elevation. If Mr. Darwin had based his generalisation on the first conclusion, few would have been prepared to dispute his ground; but in his attempt to gain fresh support for it from his theory of subsidence, he has afforded to us, in the light of the more recent accessions to our knowledge, an opportunity of exposing the incompetency of his explanation of the origin of coral reefs.

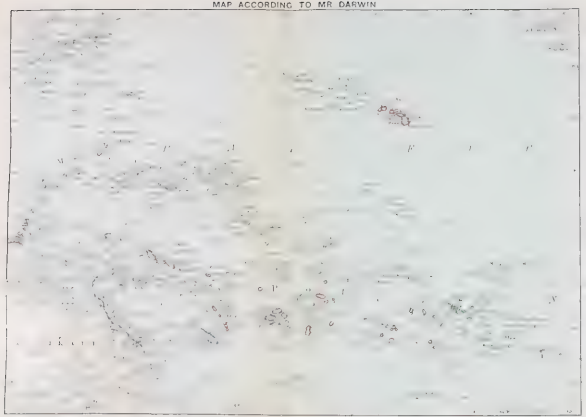
Volcanoes, he says, lie remote from regions of atolls and barrier-reefs. "There is not one active volcano within several hundred miles of an archipelago, or even a small group of atolls" (p. 141). Let us at once put these statements to the test of our more recent experience. Take, for instance, the region of the Solomon group. Here we have a double chain of mountainous islands, mainly of volcanic formation. In the island of Bougainville there is, at least, one active volcano, that of Bagana. Towards the opposite part of the group there is the active vent of Savo, which was seen in eruption in 1567. Though just at this time quiescent, it exhibited violent outbursts one and two generations ago. In addition, there are a number of volcanoes in the solfatara stage, such as those of Simbo and Vella-la-vella. Two active volcanoes also occur off the extremities of the Solomon group, namely, one in the Santa Cruz Islands, and the other near Blanche Bay, in New Britain. Extensive barrier-reefs skirt some of the larger islands, and particularly those of the western part of the group, where the volcanic forces are at present most manifest. A few small atolls rise up in the open waters between the islands. But the most important fact of all is to be found in the existence off the northern coasts of this archipelago, with its active and slumbering volcanoes, of a chain of six atolls removed at distances varying between 80 and 220 miles from the active vents. About 190 miles from the westernmost atoll (the Carteret Islands) lies the New Britain volcano, and about 200 miles from Sikyana atoll, the easternmost of the chain, rises Tinakula, the active volcano of the Santa Cruz Islands. Yet more, 18 miles from Tinakula, which is known to have been in eruption for more than 300 years, there is a living atoll of considerable size, on the windward border of which are situated the Reef Islands of the Swallow group. The Tonga Islands afford another remarkable example of the proximity of atolls and barrier-reefs to active volcanic vents. Living reefs of these classes occur within distances of from 40 to 80 miles from the long-known volcanoes of Tofoa and Lette. These facts were not known to Mr. Darwin when he wrote his work on Coral Reefs.

It will now be seen that by establishing the occurrence of barrier-reefs and atolls in regions of volcanic activity, I have placed the supporters of the theory of subsidence in a dilemma. If they regard the characters

CORAL REEFS IN THE PACIFIC OCEAN.

ILLUSTRATING MR GUPPY'S PAPER

MAP ACCORDING TO MR DARWIN



MAP, [illegible] the localities examined by Mr Darwin and described in his work, published in 1842.
GREEN Atolls. BLUE Barrier Reefs. RED Fringing Reefs.

(This Map has been constructed according to the data given in the Appendix of Mr Darwin's work.)

MAP II., showing the distribution of coral reefs in the Pacific Ocean as proposed by
GREEN Atolls. BLUE Barrier Reefs, which are fringing reefs on which subsidence has set in. RED Atolls, or reefs in process of formation, and upheaved reef formations. Upheaved Atolls are shown by the same green colour. The [illegible] and representation of the [illegible] upheaval so far as we are able to judge at present. The [illegible]

of the reefs as indicating a subsiding movement, the active volcanoes can scarcely be said to be situated in rising areas; or, on the other hand, if the volcanoes indicate regions of upheaval, the barrier-reefs and atolls cannot have been formed during subsidence. There is, however, an important fact, already alluded to, which will guide them to the right conclusion. In almost all the areas where active volcanoes, atolls, and barrier-reefs exist together, we find similar ancient reefs upraised with their foundations to a height often of several hundred feet above the sea, and possessing, as in the case of those of the Solomon Islands, a thickness no greater than the depth of the reef-coral zone. Thus, the supporters of the old theory of coral reefs are forced to the conclusion that these groups of islands, possessing active volcanoes, are placed in areas of elevation, and that it is under such conditions that their atolls and barrier-reefs have been formed. As a matter of fact, Mr. Darwin's generalisation concerning the distribution of volcanoes was in the main assured by much independent geological evidence from different parts of the world, before ever he endeavoured to connect it with his theory of subsidence, a *mésalliance* which has ensured the downfall of his explanation of coral reefs. Now, as in 1842, we regard active volcanoes as marking out regions of upheaval; but such a fact gains no support from Mr. Darwin's theory, against which it has unkindly dealt a mortal blow.

I may say in conclusion, with reference to the recent map, that I only claim for it an advance on the map of Mr. Darwin, published in 1842. So scanty is our knowledge of the physical laws affecting the growth and distribution of coral reefs, so imperfectly known, and so vaguely described, are nearly all the reef regions of the Pacific, that in our present condition of ignorance, I only aspire to obtain a greater freedom from error, and to make a nearer approach to the truth. An examination of the recent Admiralty charts of these seas, and an acquaintance with the literature referring to coral reefs, have convinced me that although we have removed a theory which has been proved to possess not even the utility of a working hypothesis, we are now face to face with a host of difficulties before unknown to us. The cloud has lifted, only to disclose many unsolved problems beyond.

List of Authorities, etc., employed in colouring the Maps.

Darwin's *Coral Reefs* (1842). Dana's *Corals and Coral Islands* (1875); also paper in *American Journal of Science*, Sept. 1885. *Pacific Islands* (3 vols. 1885), published by the Hydrographic Office. Findlay's *Pacific Directory* (1851 and last editions,) especially for the Loyalty Islands. Rosser's *North Pacific Pilot* (1870). *Australia Directory*, vol. ii. (Hydrographic Office, 1879). Jukes' *Voyage of the Fly* (1847), especially for the Australian Barrier-reef. Couthouy's *Remarks on Coral Formations* (1842). Semper's *Animal Life*, vol. xxxi., Internat. Scient. Ser., especially for the Pelews. *Sailing Directory for the Fiji Islands* (Hydrographic Office, 1882). Guppy's *Solomon Islands*, 2 vols. (1887), especially for the Western Pacific. Recent Admiralty Charts.

NEW GUINEA:
ATTEMPTED ASCENT OF MOUNT OWEN STANLEY.

By H. O. Forbes.

[We have been favoured by Mrs. Anna Forbes with the following letter from her husband, describing his late gallant and determined, but unfortunately unsuccessful, attempt to reach and ascend the great mountain which has hitherto baffled all explorers.

Besides the personal interest which naturally attaches to such an enterprise, we have, incidentally, in the letter, exceptionally graphic details as to the nature of the country traversed, and of the peculiar difficulties which beset the explorer in those parts.

Since the letter was in type Mr. Forbes has arrived in England, and arrangements are now being made for his addressing the Society in Edinburgh, Glasgow, Dundee, and Aberdeen.]

You will be eager to know the fate of the expedition. Do not be disappointed to learn that it is a failure; be glad that I am alive, for we have had a narrow escape. I got to the very foot of the last slope of Mount Owen Stanley, but the superstitions of the natives made it impossible to ascend. We were only three at the base of the mountain; to have left one in charge of our baggage would have been placing foolhardy confidence in natives who looked not altogether friendly, and to have ascended alone would have been madness. But to begin at the beginning. You know that some years ago a few diggers had reached a considerable distance into the interior with horses. Among these diggers was Gleeson (one of my party), and Mr. Douglas sent him in advance to cut any overgrown places in the route. This he did in August and returned. His report was that their furthest camp was 72 miles in a due north-east direction from Port Moresby. Now the top of Owen Stanley lies 43 miles from Port Moresby in a due north-east direction. Discounting his distances, I took it for granted that his *direction* was right, and estimated that this camp must be about 10 miles from Owen Stanley.

After fourteen days' ride over very rough country we reached the camp. Imagine my chagrin to find it close to where Chalmers and I made friends with the Ebe people, as the crow flies, about 24 miles from Port, and similarly 24 from the top of Owen Stanley. I was terribly disappointed. We made a camp there, however, shot with dynamite some 2 cwt. of fish out of the river, smoked and cured them. No natives were seen (or existed) between Port and this camp, and it was two days after our arrival before we saw a native. They were friendly at once, and came about the camp freely. We warily broached the subject of an escort to the great mountain, showed the trade we would give to any one going with us, but asked nobody. After ten days, we induced some eleven men to agree to go with us, and as this number was very small, we had to take the lowest allowance of food, clothes, and camp apparatus. I had conned the road we were to follow from a high mountain near the camp—(I should say that I had made a survey of the country all the

way, and had plotted it on a sheet carefully prepared before starting). Gleeson and Belford accompanied me. Jack and Cæsar, the two South-Sea Islanders, I left in charge of the camp and the horses. We started on 20th October, and our road lay at once from the river bank up some 2000 feet, through the Ebe village, situated right on the summit; down to the river again; across it; and up a mountain on the other side, equally high, to another village, our first stopping-place from the main camp. Here our carriers bolted, and left us to our fate among strangers, whom we found, however, very friendly.

Next morning, after much difficulty, we procured a new batch, and proceeded on our way to the "Great Water," of which last year I had heard so much. As I suspected, it proved to be the Brown River, crossed by Europeans in its upper reaches for the first time by us. Here after a ten hours' march they refused to go further, although they had promised to take us to a village where we could get as much food as we wished. We at last got them to cross over, but they now took us into a thicket, and led us about for one and a half hours. We then had to indicate that we might be called upon to use force. On this they brought us out of the maze—but not to a village. We were doubtful of their intentions. We did not understand their language, and they could comprehend only a few words of Koiari. They had all squatted on the ground, and gave us to understand that they could not, or would not, go further. We did not quite know what to do; we thought they said that the village was a long way off, but we doubted whether they were speaking the truth. We were afraid to camp where we were, without any idea of the situation of the villages, lest our friends should clear off in the night. We decided to compel them to make a fresh push for the village, which we believed must be near, for there were good gardens close by. So, ostentatiously having the Winchester rifle passed to me, I carefully loaded and cocked it, but made no demonstration with it. Then in a commanding voice I ordered our carriers forward. They comprehended the pantomime, and were evidently much scared; they quietly took up their burdens, and marched forward by a good path, which had been near, but which they had not showed us. Thence up a steep mountain—up, and up, we proceeded. The sun had now set, and I called a halt, for further progress was impossible in the dark. All the baggage was deposited on the ground, and the circle of carriers found themselves hemmed in by our three selves, each with a loaded rifle. I gave them to understand that whoever tried to escape would have to be shot, though I knew that such an extreme measure would not be necessary, and they all promised at once to do as they were bid. I ordered all arms aside, chucked each under the chin (their sign of friendship and good faith), and confidence was restored. Our tent was pitched, a fire was made, and supper cooked. We gave them a little of our cured fish, a great delicacy to them.

We watched by turns all night, but no signs of any breach of faith occurred. We were very sorry to have recourse to any compulsion, for they had carried splendidly, but our safety depended on our not being deserted two difficult days' marches out from our main camp, for we

should then have had to lose everything except food for the way. To have had to leave our baggage would have been a calamity—so much loot to them; and desertion would be the game they would play on every future traveller. Very early next morning we sent forward one of the carriers with a present of salt to bring to us the nearest villagers. At six we started forward, and about nine met quite a crowd from these villages coming to meet us—all most friendly. It took us till noon, however, to reach their dwellings, and there we camped all the rest of that day, making friends with the people, taking photos, and gathering all the information we could. We laid the carriers from the Brown River under obligation to remain here until our return from the big mountain (which was now really over against us) on penalty of forfeiting all the pay they had earned.

Next day it rained until eleven o'clock, when we struck tent, made up the "swags," and, after much persuasion, got porters to proceed with us. It was only by using pressure in a jocular sort of way, slily slipping a load on an unsuspecting man and laughing over our clever feat, and inciting all his friends to join in our mirth, that we got them to help us. When the baggage was all shouldered, quite a crowd followed, and at one village which we passed through further on, a fellow appeared who was pointed out as *the* man to guide us to the great mountain. My spirits were very high as I brought up the rear of our cavalcade, trudging along a rough ascending and descending path. A few hours brought us to the flat summit of a clear hill, and as the mist rolled off there stood Owen Stanley, with nothing between the gratification of my long and ardent desires but a ridge. On our right rose a steep and rugged mountain named Venudi, but not belonging to Owen Stanley. "There," they said, pointing to Venudi, "you see the top of what we are taking you to." "But, my friend," I said pointing to the peak of Owen Stanley, "that is where we want to go." Then came long faces and terrible grimaces. "There you cannot think of going." "What do you think will happen to you?" "Why, they will tear off your nails, pull out your joints, and eat your fingers; they will cut off your ears, they will pluck out your eyes, and then cut your head off." Their pantomime was too expressive to be misunderstood, but we laughed at their dismal tale, boasted that nothing could hurt us, or those with us, and asked them to prove the truth of our boast; but this opportunity they refused to take advantage of. I then lifted a rifle, and showed them the effect on a tree. They were greatly scared and astonished; no persuasion would, however, induce them to start with us to the top of the peak. They were quite willing to take us to Venudi, but not to Owen Stanley. One by one they began to disappear, and in a little we had very few of our carriers left. We unconcernedly pitched our camp, as it appeared of little use to force them. A message had, we found, been sent by these people to our Bereka carriers (who had stayed behind in the village to wait us) to come up, and, I suppose, explain to us the horrors of the ascent. They came; we tried to induce them to persuade the friends among whom they had brought us to take us forward. "It was an impossibility: no one ever went there and came back."

Towards evening most of the runaways had returned, and were about us when an unfortunate circumstance occurred. Belford, supposing that one of our Bereka followers was inciting the people to start with us on a false track, went up to him, and without my knowledge struck the native. I was at the moment engaged in taking an observation, and did not see what took place; on lifting my eyes I saw this fellow—he was a sort of chief—striding out of the camp in high dudgeon, and in a few seconds not a soul was left with us. A few villages were in sight on the slopes of the hill; as if by magic, they were evacuated, and all the women hid in the bush. We were now in a dangerous position, so far from our camp, and quite unable to guess whether we had made enemies of the people, or only frightened them. We passed a very unenviable night. I set a double watch, each of us having to do six hours' sentry duty; but no one disturbed us during the night, and in the morning not a sign of life was to be seen from our commanding position. If no one appeared, our only resource was to burn the whole camp equipage except what food each could carry, and make for our camp about twenty miles away, with the probability of having to fight our way through a rather populous country. About eight o'clock we perceived heads popping up here and there in the bush, disappearing the instant our eyes turned towards them. I ordered all weapons to be concealed, but still to be ready, and with some tobacco I went into the bush, made friendly signs, and called out, asking them to come to speak with me. One old man risked an approach; I touched him under the chin and embraced him, when he seemed satisfied of our friendly intentions. One by one the others hidden in the bush came in, and they at once commenced yesterday's tale of the awful things that would befall us if we tried to ascend the great mountain. We had made up our minds to return to the main camp, and were packing the equipage, but did not tell the people this, hoping that, perhaps, if they saw we were giving little heed to their weird prophecies, they might give in. When we told them we were going back to the coast they seemed very relieved, and all turned and left us except two or three old men. After long parleying we got these to shoulder the baggage (ourselves having to take a part of it also) back to the village, where we expected to find our Bereka carriers. They and the villagers, however, were at a garden some little way ahead, but we found our baggage safe—a good sign. We pressed on to the garden, where we met quite a crowd, who seemed very friendly after becoming assured of our good faith. The men, who had brought us thus far from the base of the mountain, turned to go the moment they deposited our gear, and seemed to be in a great rage about something; but I ran after them and brought them back, to pay them handsomely in red cloth, beads, and tobacco. They were overjoyed, as they evidently did not expect anything, being, I suppose, afraid we were harbouring a vindictive spirit because they had not taken us on to the mountain.

Nothing could exceed the friendliness of this large gathering, and when we proceeded we had ten times the carriers we required. The march back to the Brown River was thus most pleasantly accomplished. There we camped for the night, with the promise of the accompaniment

of this crowd back to the Bereka village. False hopes all! In the morning, with the exception of the three who were returning home, we were alone. They had all cleared off, without pay, but not without the hope of pay; to them it seemed impossible that we could take all our belongings with us, and they could return to appropriate the left goods. For some hours we tried by sending messengers to the runaways, who, we perfectly understood, were hidden in the bush, to persuade them to accompany us, but without avail. It came again to be a question of our safety. We loaded our rifles and revolvers, made the whole burdens of fifteen men into six bundles, compelled the three men with us to shoulder one each, and we each took one, and started in single file, a native between each of us, urged with the information that he would be shot on the slightest sign of perfidy. We left nothing behind us, for anything we could not carry we burned, being determined that no loot should fall into the hands of our faithless friends.

I did pity the carriers; they were really too over-burdened, but stern necessity demanded stern treatment. When we got to the river we lightened our loads by throwing our surplus stores, rice, flour, bread, into the river, as well as extra trade. You should have seen the woe-begone countenances of the men as these riches were turned into the river, to be lost irrecoverably over a near cataract! At the crossing we were joined by another Bereka man, who helped with the burdens, and a long and weary day of climbing and descending brought us to the Bereka village, one stage from our camp. They were exceedingly friendly, and we passed a comfortable night for the first time since our departure thence.

After a long series of observations which closed in the survey between our main camp and Owen Stanley, we started on the last stage to the camp, where I hoped to be able to reorganise the party, so as to leave one white man in charge of the main camp, and have the two South-Sea Islanders to strengthen us on our return to Owen Stanley for another attempt at ascent. All went well for a few hours. The day was very hot, and our road a very trying one, through grassy ascents and descents of some 2000 feet devoid of shade. About eleven a bright object like a tent attracted our attention in the Ebe village, which, as I mentioned in the beginning of my letter, stands on the crest of a hill. I got out my telescope, and recognised one of our tents. I at once suspected that something was wrong, but hid my discomfiture. A rifle was fired, while I kept my telescope on the village; at once some people appeared, and two displayed themselves conspicuously, dressed in European clothes. I was too far off to recognise their features, and had a doubt whether they were natives in our clothes, or our two men, Jack and Cæsar, who had moved our camp for some extraordinary reason.

In a few moments the tent was struck with lightning rapidity, and I realised that we had some disaster to face. The courage of my comrades failed, and our carriers at once suspected that something was wrong. They were seized with panic, and would proceed no further. I told them that the people on the mountain there were my men, and all was right. We had to descend fifteen hundred feet into the bed of the Goldie River,

and thus far I got them good-naturedly. We rested for about half-an-hour, and then started to ascend the mountain to the village where we had seen the tent, for our path lay through it. It was only by showing some force that we got the porters to move on. You may imagine how harassing it was—the urging of these men, on the verge of running away, by driving at the mouth of our guns, with the terrible anxiety as to what had happened at our main camp oppressing me. When we got about half-way up, the Ebe people refused to permit the Bereka carriers to come nearer to their village. This was, in reality, a declaration of war to them. We opened a parley, speaking at about a mile distant. They said: "If you go back to the river we shall join you there." I wanted to get to the village where the tent stood, but they firmly resisted. I could have forced them, but I was not prepared to go to extremities without knowing whether our two men were captives or killed. So we wearily scrambled down to the river again.

I must tell you that the river runs there between rocky precipices, almost perpendicular, and several hundred feet high. We were scarcely disappointed to find that no Ebe native kept the tryst; they parleyed with our men from a high bank, and out of sight. After a very short dialogue, our men threw down the baggage and sought to escape. It was a critical moment for us; we could not force our way out of the river with even a couple of men against us, and our camp, eight to ten miles distant, could be reached only by its windings—a road terrifying even to contemplate, the stream being full of slippery boulders, with pots many fathoms deep, and frequently blocked by rapids. Our safety almost certainly depended on our carriers being kept close to us, both as guides and to strengthen the defence. Luckily, they were terribly afraid of our firearms, and we hunted them back, formed them into line, and started by the only road open to us—the bed of the river. It is impossible to describe that awful march, driving our unwilling cavalcade, and surrounded by crowds of armed natives from Ebe. These latter we kept at bay by covering them every few minutes with our rifles; between clinging to the crags by a toe-hold, crossing chasms by fragile shaky trees, struggling through rapids and deep pots, from which I was rescued from drowning twice by the men whom we were driving. Then two actually escaped, getting round a corner before they could be fired on. It was sometimes almost past endurance; we had often to scale the dismal walls that held the river, the nails of my fingers were nearly all gone, and the throbbing pain from the water and dirt was most severe. It needed all my perseverance and determination not to give in. Burdened with my rifle and ammunition, and the instrument I carried (which I was loth to lose), and the weight of my drenched clothes in the hot afternoon sun, I was almost overpowered by fatigue, but if I had given way none of us would have ever reached the coast.

Some miles before reaching the camp we came upon two of our pack-saddles. It was no surprise to me, but my companions fairly broke down. We added the recovered booty to our already loaded carriers, who were doubly burdened with the loads of the two who had escaped, and—on, on. At half-past four we were near enough to the site of the camp for a shout

to be heard. We shouted, but no reply. There was a knoll just above the camp, and, with palpitating hearts, we hurried up. We were not very surprised; we had pictured pretty well what we should find. Everything was looted; all my dried plants were scattered about, everything of value was gone—my sextant, sextant-stand, watch, the new station-pointer I had just bought in Sydney, every article of clothing, books, the newly-constructed map, all the photographs I had taken, chemicals, medicines, and all our food supply except two or three tins of meat which they had not succeeded in opening. The wretched carriers, who had really served us well, we paid with what little trade we had with us. They were evidently delighted that no evil was meted out to them, and at parting even gave us three yams, for which we were grateful, for these, with the tins of meat, would carry us for the next four days to a place where we had hidden some provisions, and which would bear us to the coast if our boys, supposing they had escaped, had not used it on their flight. We now made a close examination of the camp, while one man kept guard with a rifle. We searched for signs of a fight, but there were no traces of blood, and neither corpses nor graves. Before dark I sent for the horses from the face of the neighbouring hill—the natives were too afraid to approach them—one was wanting. We counted over the pieces of the saddles scattered about. Only seven saddles—the missing saddle belonged to the missing horse. Hope revived in us that the boys had escaped with one horse, and had made for Port. You may picture my distress, for I supposed that you were there waiting my return, and it was impossible to judge when the attack was made, and how long they were in advance of us. We slept that night one at a time, and rejoiced when day broke. It took some hours to make three saddles out of the wreck of the seven, and then we at once started for the coast, a month earlier than I had intended. For the first two days we had to keep constantly on the alert, and one watched each night. I stuck to my work the whole way, never relaxing the taking of observations, and through this delay our stores were finished before we reached the hidden boxes. They had not been touched, and we could discover no horse's footsteps. We feared that our boys had really not escaped; but a recent fire near the provision camp was found with some nuts by it, which we supposed to be traces of one of the men at least. We took out enough provisions to take us to the coast, and left enough for the boys, should they have escaped and come later to seek food. We arrived at Port Moresby on Saturday night, the 5th of November, and found preparations being made for despatching an expedition to our rescue, for Jack and Cæsar—who had both come in the night before, after many dangers and difficulties, and weak from want of food—had reported our probable fate. The camp had been attacked on the Saturday and Sunday before, and we arrived on the Monday. The Saturday's attack was an attempt to loot, in which one of the natives was killed. Our boys first took him and laid him on a road, hoping his friends would take him away; after some hours they went back to look at him, and, finding him dead, they buried him.

EXPLORATIONS IN SOUTH AMERICA.

By Michael G. Mulhall.

Geographical science has made some progress in the Argentine Republic during the current year, and there is every prospect of much greater achievements in the ensuing one. Incredible as it may seem to Europeans, there are still portions of this republic, as large as Ireland or Scotland, of which little or nothing is known in Buenos Ayres. Some of the railway concessions voted during the session of Congress which has just closed traverse wilds heretofore untrodden, and therefore unsurveyed, the distance between the terminal points being estimated according to latitude and longitude. The construction of such railways will contribute, along with the efforts of the Argentine Geographical Society, to extend the scientific horizon.

An Englishman, named Bell, a man of education, courage, and endurance, unaided by the Argentine Government, or any one, spent some months of the present year in exploring the eastern slopes of the Patagonian Andes. Having completed a line of railway from the Welsh colony at Chubut to New Bay on the Atlantic, for which he was contractor, he pushed inland with the view of examining the valleys and tablelands that intervened up to the Cordillera. He reports a good deal of the country suitable either for agriculture or pasture, and the Government has agreed to give a land grant of 15,000 square miles gratis (in lieu of a guarantee on capital) to a company that will prolong the Chubut railway westward to the Andes. The Chubut colony, founded in 1863, now numbers 1200 Welsh colonists, so orderly and industrious that the only crime committed there in twenty-four years was the murder of the Deputy-Governor; he was killed by his own assistant, both being Argentines. This colony will expand and be productive of much good, following the proposed railway to the Andes.

Sheep-farmers from the Falkland Islands, Chile, and elsewhere, have begun to settle down along the Patagonian coast from Gallegos River to Cape Virgin. Gold-seekers have also been, since the summer (November) of 1886, scattered up and down near Cape Virgin, some of whom got gold-dust equivalent to £1000 sterling per head.

Land speculators, with the aid of the Government, are bent at present on opening up the Santa Cruz watershed to settlers. It lies between the 49th and 51st parallels of S. lat., embracing the rivers Santa Cruz, Chico, and Chalia, which seem to draw their supply from Lakes Argentino, Biedma, and San Martin, so called by the explorer Francisco Moreno in 1878. These lakes were visited in 1873 by Captain Lawrence and Lieutenant Feilberg, of the Argentine navy; the first of them is 30 miles above Fitzroy's Rapids, to which point Darwin reached in 1833, in the expedition of H.M.S. *Beagle*. Most of the Santa Cruz valley is unfit for anything, comprising layers of basalt, arid platforms, and desert wastes;

but there are green meadows along the river in many places, and I have heard an Englishman say the country would do for raising sheep. More probably the shores of Lake Argentino, 180 miles from the Atlantic, would offer sites for colonisation, as there are forests near Point Walichu (a word signifying 'demon' or 'deceased physician'). The Argentine Government has opened emigration agencies in Great Britain, and I feel bound to caution my countrymen against accepting farm lots in Santa Cruz valley, if such be proposed.

Two American dentists of Buenos Ayres sent out an exploring party a year ago to search for gold and petroleum, along the Andine slopes from Mendoza to Magellan's Straits. Whatever the result, nothing has been made public. The interval to be traversed was 20 degrees of latitude, from 32° to 52°, which was perhaps too vast for a couple of Oregon miners to examine in even the most cursory manner. Gold was never found there, although in the last century every inch of that territory was known to the English Jesuit, Father Falkner, who spent thirty years there among the Indians (1737-67). It was also well known to Captain Masters. Petroleum is found about 30 miles south of San Rafael, in a well giving 40 per cent. oil, but no efforts have been made to turn it to account. Congress, however, having last week granted a concession for a railway (with 5 per cent. guarantee on capital) from Buenos Ayres to San Rafael, this oil business may be taken up and prove important. Government levies a duty of 200 per cent. on all United States petroleum imported. A railway already exists from Buenos Ayres to Nueve de Julio; the prolongation to San Rafael will be 450 miles, and is to cost £3,350,000 sterling, opening up pampas first crossed by Mr. Robert Crawford's expedition to the Planchon in 1873.

An expedition has just been arranged between the Argentine Geographical Society and the Prime Minister, Dr. Edward Wilde, to complete the surveys begun by Colonel Fontana two years ago respecting the supposed river flowing from the Argentine or eastern side through the Andes to the Pacific Ocean. This seems to me impossible or nearly so, but is currently believed. I may observe that when the Anglo-Chilian explorer, William Cox, set out on his first expedition from Valdivia to Lake Nahuel-Huapi, in 1864, he had a vague idea of some river from that lake, on the eastern slope, flowing through the Andes into Chile, but was convinced of the error. Among the railways just voted by Congress is the Bustamante concession, for a line from Buenos Ayres, or rather from Bahia Blanca, to Chile by way of Lake Nahuel-Huapi and the Bariloche pass, length 800 miles, to cost £5,600,000 sterling, with a 6 per cent. guarantee. The engineers will very soon throw much light on this new territory, which is one of special interest. The lake covers an area of 1000 square miles, being 60 miles in length, surrounded by the most superb scenery of forests and extinct snow-capped volcanoes. As the Bariloche pass is only 2770 feet over sea-level, it will offer a much easier crossing over the Andes than Messrs. Clark's Pacific line now in con-

struction from Mendoza to Chile by the Uspallata pass (10,600 feet above sea); but the latter is the direct route from Buenos Ayres to Valparaiso, and less than half the distance of the other. Geological science may gain something by Clark's line, which already climbs the eastern side of the Cordillera and promises completion within four years. Messrs. Clark, sons of a Scottish settler in Chile, spent ten years in examining the Andine passes; they are at present also constructing four other railways in Venezuela, Misiones, Corrientes, and Buenos Ayres.

Mr. Francis Younger, an old resident, has just received a valuable concession for a railway from Corrientes to Bolivia, which will cross the Gran Chaco in a direction hitherto only known to Indians; estimated length 560 miles, cost £5,100,000 sterling. We have neither surveys nor details of any kind, as, in fact, nobody knows whether Mr. Younger's engineers will find the most of the route to be swamp, prairie, or forest. The line starts from the west bank of the Paranà, opposite Corrientes, goes N.W., crossing the Bermejo, and terminating at Tartagal on the Bolivian frontier. Congress has also given concession for a parallel line to Mr. Tanus, terminating at Oran, length 620 miles, so that before long the mysterious Gran Chaco will be as free to travellers as from London to Edinburgh. The first white man who crossed the Gran Chaco was Luke Cressol, in 1826, whom I met in Paraguay twenty-five years ago; he had been many years held prisoner by Francia, the tyrant, for his exploring character. The second was Dr. Josè Maria Arce, in 1863, a Bolivian gentleman, appointed envoy to Buenos Ayres, who was eight months coming from Bolivia to Corrientes, and lost two men, shot by Indians.

Misiones is another dark country, of which more was known 200 years ago than at present. Dense forests have overgrown the roads, villages, and establishments of the Jesuits, in which it is unsafe for a traveller to enter, as wild beasts abound. It was a land flowing with milk and honey, and will soon be so again. Captain Hunter Davison, an American, has published hydrographic notes and surveys of the highest importance on the Upper Paranà. We may expect similar light as regards the land of Misiones from Messrs. Clark's engineers, who commence operations with the new year (1888). This railway will be a continuation of the East Argentine, running along the west bank of the Uruguay from Caseros to Santo Tomè, then crossing Misiones to Posadas (on some maps marked Itapna), which is an outlet for the trade of southern Paraguay. Dr. William Stewart of Asunçion, native of Galashiels, N.B., has received a concession from the Paraguayan Government for a railway to connect Itapna with Asunçion. That part of Misiones which is washed by the Uruguay has been opened up since 1882 by the settlement of various sugar plantations, especially one belonging to Hebrew capitalists of London. Soil and climate are unsurpassed, and if any British emigrants think of this republic at all, I am of opinion that Misiones might suit them. However, the local authorities are often too arbitrary for English ideas, and the experiment would be hazardous.

In the north-western parts of the republic, five or six railways are to be commenced next year, which will make known vast territories at present so thinly populated as to be practically outside the world. For instance, the line from San Juan to Rioja will cross the Argentine Zahara, besides skirting some mountain ranges in which silver abounds. Another line, from Rioja to Chilecito and Famatina, will tap the richest mining district in the republic, and perhaps in South America ; the establishment of Mr. Samuel Lafone is said to be the finest mining-works on this side of the Andes. The Portalis concession for a railway southward from Rioja to Mercedes (Rio Quinto), traverses a bleak, desolate, and untrodden wilderness for at least 300 miles. In the extreme north, Messrs. Jackson are prolonging railway lines to Salta, Injuy and the Bolivian frontier, through districts so remote from contact that the Spanish language has not yet superseded the Quichua or Aymarà of the Indians. In a corner of Injuy, beyond the Sierra Cortaderas, Messrs. Carlyle and other Englishmen have gold-washings, in which numbers of Indians are employed.

It may be truly said that the progress of exploration goes hand-in-hand with the new railways, already begun, or for which concessions have been granted, viz. :—

Contractor.	Name of Line.	Estimated cost.	Miles.
Younger	Resistencia to Tartagal	£5,100,000	560
Quiroga	San Juan to Chumbicha	1,800,000	190
Prudhomme	Chilecito to Famatina	280,000	35
Clark	Buenos Ayres and Pacific	5,200,000	740
Jackson	Salta and Injuy	5,200,000	560
Bustamante	Bahia Blanca and Chile	5,600,000	800
Clark	Corrientes and Misiones (2)	4,000,000	430
Loza	Goya to Casseros	1,100,000	120
Pelaez	Reconquista to Formosa	2,600,000	280
Dabreu	Bahia Blanca to Rio Quinto	4,500,000	700
Sanchez	San Juan to Salta	6,900,000	625
Carranza	Chumbicha to Andalgalà	1,200,000	190
Portalis	Rioja to Rio Quinto	2,600,000	370
Tauus	Resistencia to Oran	4,000,000	625
Marti nez	Rio Bormejo and Nanducito.	2,000,000	410
Artayeta	Nueve Julio to San Rafael	3,300,000	450
Portalis	Tucuman and San Cristobal	2,200,000	370
		£57,580,000	7,455

The Government guarantee varies from 5 per cent. on some lines to 7 per cent. on others, the average being 5½ per cent., or about £3,000,000 per annum on the above total. As the lines can hardly earn more than one-third, or, in a few cases, one-half the guaranteed interest, the Government will have to make good about £1,500,000 per annum.

As regards exploration in the neighbouring countries, we may expect some progress next year in the Paraguayan Chaco on the west bank of

the river Paraguay, as the Congress of Asunçion has recently granted a concession for a railway from Paraguay to Bolivia and Peru, with a liberal land-grant on either side of the line. Large tracts of land along that route are held by Englishmen and others in Buenos Ayres, who bought it at very low prices from the Paraguayan Government; these lands have now risen to $1000 per square league—say £25 sterling per square mile—but the Guaycuru Indians are still in possession. Surveys have been made in those parts near the river Pilcomayo; there is plenty of wood and water, prairie, and palm-forests.

Boundary commissioners for the Argentine and Brazilian Governments proceeded last March to the Misiones, beyond San Borja and the Falls of Iguazù, to mark out the limits in that quarter. They are proceeding with their labours, although two have already succumbed to exposure and hardship. As soon as any report may be published, I shall have the honour of transmitting an English version of same to the Society.

Buenos Ayres, *December* 1, 1887.

THE WELLE PROBLEM.

The following is a translation of a communication received by us from Dr. Schweinfurth in reference to M. J. de Jankó's paper on the Welle Problem, published in the Magazine for January 1888:—

"I have read with great interest M. J. de Jankó's exposition of the Welle problem, which leaves nothing to wish in regard to its clearness and forcible treatment. But his hypotheses, being based on false premises, will scarcely find any support. This is specially the case in the Mbomu-Kuta hypothesis, which at first sight appears very seductive. The maps up to the present published by Dr. Junker are mere sketch-maps; and they were prepared simply to elucidate the addresses delivered by him to the various Geographical Societies. The best reproduction of Dr. Junker's map appeared in the *Proceedings of the Royal Geographical Society* for July 1887, which was a reduction of the large wall-map hastily prepared by me in Cairo for Dr. Junker. As for the correction of the latter, I would observe that it has been based upon the detailed route-maps elaborated by the traveller during his enforced stay in the Egyptian Equatorial Province, according to his actual discoveries. These were transferred by me to the large map I prepared for him, without any further alteration than was required to reconcile it with the distances and positions already accurately determined and defined by previous travellers. The innumerable small rivers, localities, hills, etc.—thousands of names—were entirely left out. It was only necessary to give a clear and uniform representation of the vast extent of territory traversed by the great explorer. The large number of detailed maps brought back by Dr. Junker were subsequently worked up by experts. Herr Hassenstein in

Gotha had sufficiently achieved this work to enable the map to be published by *Petermann's Mitteilungen*. I regret that M. de Jankó omitted to examine this great work; he would at once have seen that his hypotheses, especially in regard to the Werre, were false. To return to Dr. Junker's provisional sketch-map, I should like to add that the newest publications of the Royal Geographical Society's *Proceedings* and of *Petermann's Mitteilungen*, in regard to the delineation of the Congo, were embodied in it; which must differ somewhat from Ravenstein and Habenicht's maps (Gotha, April 1886), as these depended on older sources of information. As regards detail, in whatever respect these last-mentioned maps may be superior to Dr. Junker's map, they are founded on itineraries of journeys, given by the same traveller in provisional sketch-maps, which, before coming into Mr. Ravenstein's possession, were sent to Lupton and Emin. A portion of this detailed information, moreover, was supplied by Herr Bohndorff, Dr. Junker's companion, who had preceded him in his return home, and on his arrival in 1884 his own, as well as a portion of Dr. Junker's, intineraries were made public.

"I should like to refer to a few points in M. de Jankó's paper:—*Page* 46.—The author judges of the Ubangi only by its breadth and depth, and therefore obtains an imperfect estimate of its volume at Grenfell's Furthest. Does he forget that the mighty Congo itself, in its lower, is thirty times as broad as in its upper, course, and narrows without losing its volume? The rate of flow changes commensurately. Moreover, the Ubangi at the Zougo Rapids, according to Captain van Gèle's observations (Supplement to the *Mouvement Géographique* of 8th May 1887) is not 660 yards but 800 mètres (875 yards), and at this spot the map shows a considerable narrowing of the stream in the line of the four islands forming the cataracts. Several considerable tributaries—perhaps even the main river—may have escaped the notice of the two former explorers (Grenfell and Van Gèle), even as the mouth of the Ubangi was not observed by Stanley and others, who passed both up and down the Congo: such cases are not rare in the history of Central African exploration.

"In reference to the difference mentioned by M. de Jankó (on p. 46) between Junker's newest map and his earlier maps, the latter of which he says, "are both more detailed and more exact," I need not again allude to what I have already said in this respect. As regards the distance between Foro and the river Kuta-Mbomu, I have to state that Lupton himself must have been in uncertainty about this, for, from his paper in the *Proceedings* of the Royal Geographical Society and his letters to Dr. Junker (the originals of which are in Mr. Ravenstein's possession), a different number of days occupied in the journey is given. When Dr. Junker, on his journey from Mbanga (Mofio) to Alikobo's zeriba on the Welle-Makua, after coming to the Mbomu, reached this, his most westerly point on the Welle, he knew that the Mbomu flowed invariably at a few days' journey to the west of his route, to the WSW. or SW., and he had definite information of the confluence of the Mbomu with the Welle,

because at that spot was situated a zeriba of Wed Osman, with whose people he was acquainted, exactly at the spot named Bangusso by Dr. Junker, and which in all probability is identical with Lupton's Bargusso, the limit of his southerly journey from Foro.

"*Page* 48.—If M. de Jankó is supported by the assumption that Junker only communicated verbal reports received by him, and that the statements of natives appeared worthless in the face of Stanley's experience at Nyangwe, where it was stated the Lualaba flowed northwards to the Nile, then I would like to request him to compare together the distances on the map lying between Nyangwe and the Stanley Falls (to the point where the Lualaba makes the westerly bend), on the one hand, and between Junker's most westerly point on the Welle and the lower course of the Mbomu, on the other hand,—only a few days' journey distant.

"The assertion of Nachtigal's servant can have no weight in this matter. The newest maps of Africa which still retain information of this sort, are more worthy of Ptolemy's time than of a Petermann or a Ravenstein. I have in my mind the region of the Upper Shari, and I ask, Has any one ever seen a riverain island like that shown at the junction of the Bahr-el-Ardhe and the Bahr-el-Azrak, between Shari and Serbewuël (300 miles long)? In the 25 square degrees of unexplored country east of Foro the Shari has room enough to develop its source. Against the assumption of the union of the Mbomu with the Shari, we must remember the fact that, according to Lupton's own observations, all waters east of Foro flow south or east to the Mbomu, whereas the rivers at the source of the Shari, west of Foro, are said to flow from east to west. Foro appears to be situated on the watershed, and to point to a considerable elevation and extension of that part of the country, so as to dominate on both sides the two river-basins.

"*Page* 47.—I am astounded to read M. de Jankó's wish, in regard to Dr. Junker, that he should pay "more regard to the existing literature bearing upon his subject, and to the cartography of the same." Is he to correct his former inaccuracies in a district concerning which he is the sole source and authority? What would Mr. Ravenstein say to that?

"Let us pass over the point of confluence between the Mbomu and the Welle-Makua, which was certainly not seen by Dr. Junker, and their relation. What of the Werre?—which M. de Jankó also includes within his sphere of conjecture. Of this river and its hydrographical basin, he is clearly very imperfectly informed. On Junker's sketch-map the confluence of the Werre with the Welle is placed in 25° E. long., close to the spot where the traveller reached the Welle. I am not sure whether he saw the mouth of the Werre with his own eyes; at all events, being so near the spot, he must have received accurate information. How, therefore, can the Werre belong to the Ubangi? Did Dr. Junker cross it at no place in its lower course when on his journey to Alikobo's zeriba on the Makua? Dr. Junker reached the Welle-Makua at nine or ten places, and crossed it at three; how could he doubt that it was one and

the same river? This district lies between the Werre and the mouth of the Mbomu. From thence to the Welle-Makua the fisheries and river navigation belong, as a monopoly, to a single tribe, the A-Bassongó, who repeatedly gave the traveller accurate information in regard to the course of the river. Dr. Junker also learned from them that at no place within the territory traversed by him was there any interruption to navigation.

"Above all, before venturing on new hypotheses, we must wait for the special map of Dr. Junker's journey prepared by Herr Bruno Hassentein.

"Cairo, 22*d January* 1888."

THE PARTITION OF CENTRAL AFRICA.

(With Maps.)

By Arthur Silva White, F.R.S.E.,

Secretary to the Royal Scottish Geographical Society.

It may be instructive at this time to present the Society with a map of Central Africa showing the extent to which the recent development of "land-eating" among the European Powers has resulted in claims, protectorates, colonies, and "spheres of influence" being applied to every unclaimed territory. The "Dark Continent," at least on the map, is now illuminated with a variety of colourings: indeed, it must be difficult for cartographers to keep pace with the frequent announcements of territorial acquisitions.

Mr. J. G. Bartholomew has prepared two maps, the first showing the division of territory according to claims, the second according to agreements. The "claims" have been advanced either by European Governments or by private Associations; the "agreements" have been arrived at between States. It would be beyond our purpose to inquire into the validity of these so-called claims: for the most they are based upon simple private announcements, and have been secured by means which certainly could not be justified by International Law. The British Government has always been slow to accept the responsibility of administering foreign possessions, or safe-guarding protectorates, unless its promise were capable of translation into action; hence, there are some large districts in Central Africa, now claimed by other European Powers, in which British merchants, British explorers, or British missionaries and philanthropists, have for years past been slowly making their influence felt, exploring and opening up the country, and—when they might naturally look for some compensation—have finally witnessed the fruit of their labour gathered up by new comers. Take for example, the Lakes District of Central Africa, and the approach to them from the South. The student of geography might well suppose, from the colouring on the accompanying maps, that this large and important district owed its present comparative prosperity to the efforts of the Powers who now lay claim to it. But if

he searched the annals of Central African history—from the time when Dr. Livingstone nearly thirty years ago entered the threshold of this unknown land, and said, "I have opened the door; I leave it to you to see that no one closes it after me"—to the present date; if he inquired of Geography, "Who discovered these great lakes, explored the rivers and territories, brought a message of peace to the barbarian indigenes, and worked among them as fellow-labourers?"—he would learn that it was mainly to British enterprise that we owe the present state and knowledge of these lands.

It is not from British sources of information that we have been able to obtain the data employed in the preparation of our maps. These have been gleaned to a large extent from German publications, and this is specially the case in regard to the new conventions, the texts, or purport, of which we give. Unfortunately, Her Majesty's Government take no practical steps to place such information at the disposal of those most interested in it; and the Blue Books that are published are only occasionally noticed by the press. Geographical Societies are therefore called upon to intervene.

We are aware that much of the information we now publish, both in the maps and in the text, may be challenged for its accuracy by many whose opinions or knowledge deserve our confidence; but as no two authorities appear to be agreed in the matter—the importance of which cannot be over-estimated—we desire to take the initiative in bringing it to a definite issue. We have taken every care to collect reliable data; if, in certain respects, it is confusing or misleading, it is because the information at our command is imperfect. Our hope is that, by bringing the matter prominently before the public, it may lead to an adjustment of conflicting claims, and a permanent settlement of British and foreign interests within the whole district under discussion.

Previous to 1884, the continental lands on the East Coast, opposite Zanzibar, were almost exclusively under British influence, though for some years previous to that date a large French house and a still larger German house were competing with some success against British merchants. The principal traders were British subjects, and the Sultan's government was administered under the advice of the British Resident. The whole district from the coast to Lakes Nyassa and Tanganyika was claimed by the Sultan; the various chiefs acknowledged his claims to a certain extent; and his aid was invariably invoked if any European travellers got into trouble. Still, Great Britain had no territorial claims. But in 1884-85, Dr. Karl Peters concluded treaties with the native chiefs of Useguha, Ukami, Nguru, and Usagara, by which he "acquired" their territories for the Society for German Colonisation. Returning to Berlin in February 1885, Dr. Peters obtained for these acquisitions of territory the first Imperial "Schutzbrief," or Letter of Protection. The remonstrances of the Sultan of Zanzibar and the British press were followed by the appearance off Zanzibar in August 1885, of a German fleet, which, according to a German periodical, had been despatched to show "clearly the meaning of an Imperial Schutzbrief." Negotiations between Britain and Germany, into which France was

drawn, resulted in the appointment of a Delimitation Commission. On 29th October 1886, an agreement was signed by Lord Iddesleigh and Count Hatzfeldt in regard to the Sultanate of Zanzibar and the delimitation of the British and German spheres of influence on the East Coast. The terms of this Convention were made public by the German official organ, the *Reichsanzeiger*, of 30th December last. It has, however, not yet been published by Her Majesty's Government, but it is known that Mr. Holmwood, our representative at Zanzibar, obtained the Sultan's adhesion to it early last year.

Briefly stated, the terms of this Anglo-German Convention are as follows:—

I. Both Powers recognise the sovereignty of the Sultan of Zanzibar over the islands of Zanzibar and Pemba, Lamu and Mafia, as also over those small islands lying within a circuit of 12 nautical miles of Zanzibar. Both Powers also recognise as the Sultan's possessions on the mainland an uninterrupted coast-line from the mouth of the Miningani River at the entrance of the bay of Tunghi (south of Cape Delgado) as far as Kipini (south of Wito). This line encloses a coast of 10 nautical miles inland for the whole distance. The northern boundary includes Kau; north of Kipini, both Powers recognise as belonging to the Sultan of Zanzibar the stations of Kisimayu, Brava, Merka, and Makdishu (Magadoxo), each with a land circuit of 10 nautical miles, and Warsheikh with a land circuit of 5 nautical miles.

II. Great Britain engages herself to support those negotiations of Germany with the Sultan which have for their object the farming out (*Verpachtung*) of the customs in the harbours of Dar-es-Salaam and Pangani to the German East African Association, on the payment by the Association to the Sultan of an annual guaranteed sum of money.

III. Both Powers agree to undertake a delimitation of their respective spheres of influence in this portion of the East African Continent. This territory shall be considered as bounded on the south by the Rovuma River, and on the north by a line, commencing from the mouth of the Tana River, following the course of this river or its tributaries, to the intersection of the Equator with the 38th degree of east longitude, and from thence continued in a straight line to the intersection of the first degree of north latitude with the 37th degree of east longitude. The line of demarcation shall start from the mouth of the river Wanga, or Umbe, and follow a straight course to Lake Jipé (south-east of Kilima-njaro), along the eastern shore and round the northern shore of the lake, across the river Lumi, passing between the territories of Taveta and Chagga, and then along the northern slope of the Kilima-njaro range, and continued in a straight line to the point on the eastern shore of Lake Victoria Nyanza which is intersected by the 1st degree of south latitude.

Great Britain engages herself to make no territorial acquisitions, to accept no Protectorates, and not to compete with the spread of German influence to the south of this line, whilst Germany engages herself to observe a similar abstinence in the territories to the north of this line.

IV. Great Britain will use her influence to promote the conclusion of a friendly agreement concerning the existing claims of the Sultan of

Zanzibar and the German East African Association, on the Kilima-njaro territory.

V. Both Powers recognise as belonging to Wito, the coast stretching from the north of Kipini to the north end of Manda Bay.

VI. Great Britain and Germany will conjointly call upon the Sultan of Zanzibar to recognise the General Act of the Berlin Conference, save and except the existing rights of His Highness as laid down in Art. I. of the Act.

VII. Germany binds herself to become a party to the Note signed by Great Britain and France on 10th March 1862, in regard to the recognition of the independence of Zanzibar.

These are the terms of the London Convention, which alone have any validity. But the German sphere of influence, as defined on the map by the German East African Association, is made to extend much further to the west. Based upon private treaties, and on one concluded with Portugal (to which we shall subsequently refer), it is claimed as stretching from the boundaries of the Congo Free State to the sea, the limit of the northern boundary-line fixed by the London Convention being prolonged on the same latitude to the shores of Muta-Nzige, and the southern boundary being conterminous with the Portuguese Possessions, as far as Lake Bangweolo and the Luapula. We mention this claim for what it is worth. Of course, we do not recognise it. Undoubtedly, but for the intervention of Her Majesty's Government, the German sphere of influence might have been indefinitely enlarged; but it cannot be conceived that our long-standing interests, supremacy and claims in East Africa, which are thus passed over so lightly by the German East African Association, will be permitted to suffer from the injustice with which they are now threatened.

These "claims" of the German East African Association must not be treated seriously. On a map which Mr. E. G. Ravenstein prepared for the Royal Geographical Society (*v. Proceedings*, August 1887) they are accurately shown. The Company have no treaty rights whatever in these vast territories, into the greater part of which their travellers and explorers have never penetrated; and, as a matter of fact, no agreements whatever have been made by them with tribes bordering upon the Nyassa or Tanganyika. Outside the official German Protectorate the Association owns a large number of stations (the furthest inland being at Mpwapwa), but Germany has no claims whatever to any part of the shore of Lake Nyassa, nor to the country traversed by the so-called "Stevenson Road" (between Lakes Nyassa and Tanganyika).

The German claims on the East Coast would thus comprise an area far greater than the German Empire. The Protectorate has, however, only been proclaimed over Wito Land (acquired by the brothers Denhardt), and the territories of Usagara, Useguha, and Ukami (acquired by Dr. Peters, Dr. Jühlke, and Count Pfeil, for the German East African Association, and included in the "Schutzbrief" of 27th February 1885). The other territories claimed by the Association, which have not yet been placed under the Protectorate, are Khutu (acquired by Count Pfeil, 10th June 1885),

the whole of the Kilima-njaro territory, from Pangani north-west to $2\frac{1}{2}^{\circ}$ S. latitude, with the lands of Usambara, Pare, Arusha, and Chagga (acquired by Dr. Jühlke and Lieutenant Weiss), Usaramo, with all the lands between Ukami and Rufiji (acquired by Lieutenant Schmidt, 2d Sept. 1885), the mountain district of Uhehe (acquired by Count Pfeil and Lieutenant Schlüter), the lands of Ubena, Wamachonde, Mahenge, and Wangindo (acquired by Count Pfeil and Lieut. Schlüter), and Gasi Bay, with "the rights of the house of Msara" (the old ruler of Mombassa). It is clear, however, that this latter claim is barred by the agreement between England and Germany, while, if Germany can extend her influence westward to the south of the line of demarcation, Great Britain has far more scope for such extension to its north.

Immediately after the granting of the "Schutzbrief," the Society for German Colonisation transferred (April 1887) their rights to the newly-founded German East African Association, at whose head was Dr. Karl Peters. Expedition after expedition was despatched by the Association to make fresh acquisitions. Relations with some of the Somal tribes were also opened up: Dr. Jühlke, before his assassination, negotiated several treaties, upon the strength of which all the Somal coast between the British sphere on the East Coast and in the Gulf of Aden is claimed by the Association. But the German claims on the Somal coast cannot be treated seriously. Dr. Karl Peters himself headed a large expedition to East Africa; and about the same time, the British East African Association was constituted. The narrow coastal strip reserved to the Sultan of Zanzibar by the London Convention has been acquired by the British and German Associations, by the payment of an annual sum of money, for a term of fifty years, each Association acting on the coast opposite its respective sphere.

Germany also becomes a near neighbour of Portugal on the West Coast. A treaty was concluded (21st July 1887) between the two Powers, which provides that:—The southern boundary of Angola shall be marked by the course of the Cunene from its mouth to the second cataract in the Chella or Kanna Mountains; from thence by the same parallel of latitude on which these falls are situated to the Kubango, the boundary following the course of this stream as far as Andara, from whence the boundary stretches in a straight line to the Zambesi in the district of the rapids of Katima. Germany engages herself to make no acquisitions of territory, and not to accept Protectorates, nor to compete against the Portuguese influence, in the territories lying between Angola and Mozambique. According to this convention, German interests extend to the south end of Lake Tanganyika; and on the East Coast, the northern boundary of Mozambique is defined by the course of the Rovuma to its confluence with the Msinje, from whence it continues on the same latitude to Lake Nyassa: both of which claims we repudiate.

The boundary between the German Colony of Cameroons and the British Protectorate in the Niger district was agreed upon in the beginning of 1885 (*Reichsanzeiger*, 26th August 1886). The line separating the British and German spheres on the West Coast follows the Rio del Rey, from whence it passes to the rapids of the Old Calabar River

and proceeds direct to the east of Yola (Adamawa), thus securing the whole of the Benue (which the German traveller Flegel had hoped to secure for his countrymen) to Great Britain.

The Royal Niger Company, by the charter which it obtained in 1886, conferring the power to make treaties, possess sovereign rights over the whole of the Niger from Timbuktu, and of the Benue from Yola, extending on both banks of the rivers for 30 miles inland. These rights were acquired for the Company by their envoy, Mr. Joseph Thomson, by the treaties he concluded in 1885 with the Sultans of Gandu and Sokoto.

The British Protectorate over the Niger districts includes the territories on the coast between the British Protectorate of Lagos and the right or west bank of the Rio del Rey, at its mouth. It further includes the territories on both banks of the Niger, from its confluence with the Benue at Lokoja to the sea, as also those on both banks of the Benue, from its confluence, to and including Yola. This territorial extension of the British possessions is based on a convention between Britain and Germany, on whose behalf it was recognised in a note from the German Ambassador under date 7th May 1885. Germany declared herself ready to withdraw her protest against the hoisting of the British flag at Santa Lucia Bay, and not to undertake Protectorates nor acquire territory between the colony of Natal and Delagoa Bay. The acquisition of Santa Lucia Bay by Aug. Einwald, and the extension by the late Dr. Nachtigal of the Germam Protectorate, on the Mahin Coast, east of Lagos, have therefore been annulled by contract between Great Britain and Germany. In August 1885, Portugal undertook the Protectorate over the kingdom of Dahomey, but according to the *Deutsche Kolonialzeitung* (No. 2, 1888), Portugal has recently relinquished her rights, in consequence of the difficulty she found in enforcing them; and the Powers have been informed of this step.

On the 24th December 1885, the delimitation between the German and French spheres of influence was agreed upon. In the terms of this convention, Germany renounced all rights over Koba and Kabitai (in S. Senegambia), and recognised the sovereignty of France over the territories between the Nunez and Mellacoree. Germany also recognised the French Protectorate over Great Popo, on the Slave Coast, and France recognised the German Protectorate over Togo-land and its extension to Porto Seguro and Little Popo. The boundary line between the German colony of Cameroons and the French colony of the Gabun is marked by the course of the river Campo to 10° E. longitude, and from thence on the same parallel of latitude to 15° E. longitude. France relinquished all claims to Malimba and Great Batanga, and Germany reciprocated by giving up her claims on Bata, Banoko, and Benito. This convention, in conjunction with that made with Great Britain in the previous year, as regards the northern boundary, definitely defines the boundaries of the Cameroons Colony.

On May 15, 1886, France and Portugal came to an agreement in regard to the delimitation of their territories in Guinea and in the territories to the north of the Congo. Portugal then ceded to France the possession of Zighuichor on the Casamanze, whilst France relinquished

her claims on Bissama and on the banks of the Cassini. Portugal further recognised the French Protectorate over Futa Jallon; and the Portuguese colony of Kabinda, north of the Congo, was considerably extended to the north.

These, briefly, are the data upon which our maps have been constructed. We cordially invite criticism, and trust we may thereby be placed in a position to lay before our Readers, in a subsequent number of the Magazine, a more accurate definition of the existing claims of the European Powers in Central and Southern Africa.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Diplomas of Fellowship.

The Council of the Royal Scottish Geographical Society has awarded the Honorary Diploma of Fellowship to Mr. Hugh A. Webster, F.R.S.E., Librarian to the University of Edinburgh, and to Sir Charles Bernard, K.C.S.I., late Chief Commissioner of Burma.

The Diploma of Fellowship has been granted by the Council to the following Ordinary Members of the Society, on their application:—Robert Anderson, Esq.; Commander William Brown, R.N.; Hugh Cameron, Esq.; J. Macnaught Campbell, Esq.; John Shedden Dobie, Esq.; J. M. Easton, Esq., A.M.I.C.E.; Thomas Gibson, Esq.; R. D. Graham, Esq.; Joseph J. Henderson, Esq.; Robert Kerr, Esq.; Alexander Laing, Esq.; John Maclaren, Esq.; Admiral Mansell; George M. M'Lauchlan, Esq.; Dr. Hugh Robert Mill, F.R.S.E.; William Morton, Esq.; James Hunter Russell, Esq.; Frederick Taysen, Esq.; Alexander B. Thomson, Esq., M.A.; Charles Wilson, Esq.; and Charles J. Wilson, Esq.

GEOGRAPHICAL NOTES.

EUROPE.

Iceland.—Dr. Labonne, who has been charged with a second mission to Iceland by the French Minister of Public Instruction, has sent to the Paris Geographical Society a report of his explorations. He first explains that many of the rocks facing Point Reykjanes, of volcanic origin, were elevated in the year 1783, at the time of the famous eruption of Skaptar Jökull. Being satisfied on this head, Dr. Labonne sought for the line of fracture, and he now states that it extends from Reykjanes Point to the volcano of Askja. "If, as I did," he says, 'one leaves Reykjanes Point to proceed to Skaptar, one meets first hot-water springs, then large crevices, fissures from whence escape clouds of a sulphurous acid or steam, Hekla, small geysers to the south of the great ones, etc., which present evident signs of a line of volcanic activity leading to Askja." As a result of this investigation, Hekla is thus shown to be, not an isolated volcano, as usually described, but connected with Askja by a subterranean passage; and as a proof of this assumption, Dr. Labonne adds that, during the terrible eruption of Askja in 1875, the environs of Hekla also ejected smoke.

EUROPEAN POSSESSIONS AND CLAIMS IN CENTRAL AND SOUTHERN AFRICA.

SKETCH MAP SHOWING DIVISION ACCORDING TO AGREEMENTS

SKETCH MAP SHOWING DIVISION ACCORDING TO CLAIMS

KEY TO COLOURING

BRITISH · FRENCH · GERMAN · ITALIAN · PORTUGUESE · SPANISH · CONGO STATE

The Öresund.—M. Hansen-Blangsted, in a communication to the Paris Geographical Society, calls attention to the perpetuation on our maps of geographical names which have carelessly been given. He insists, and with great reason, that for "the Sound," which separates the Danish island of Zealand from the Swedish coast-line, we should adopt the more exact designation of *Öresund* (*Ö* or *Öre* meaning "low sandy shore in form of a hook," and *sund* meaning "strait").

Spain and Portugal.—M. de Botella has published a work in Spanish entitled *Morphological Geography of the Peninsula; Law of Distribution of its Mountain Chains, Coasts, and Water-courses*, which is an elaborate study of the mountain chains of Spain. Geographically, these mountain chains limit the five great hydrographical basins of the Douro, Ebro, Tagus, Guadiana, and Guadalquivir. A map illustrating the text shows, by a superimposed diagram, the direction of the watersheds, rivers, and water-courses, etc., of the Peninsula.

ASIA.

Irawadi Expedition.—The Irawadi Flotilla Company, whose steamers have hitherto not carried freight beyond Bhamo, last year despatched an expedition under Captain Rimmer to explore the upper course of the river. Writing from Tsenbo on 15th December last, Captain Rimmer gives a short account of his travels. He says there is nothing to prevent vessels of a certain build from running regularly through the defiles, at least during the low season. According to native report, the water is very strong and turbulent in the high season, and Captain Rimmer could not give an opinion as to the continuance of navigation throughout the year. Above the defiles the river opens out, and the country becomes flat and apparently exceedingly fertile; and, if this continues for any distance, considerable trade, in the opinion of Captain Rimmer, might be expected if regular means of communication could be maintained. The villages in the defiles are small, but very numerous; the inhabitants, Burmese-Shans, received the travellers well. The passage from Bhamo to Tsenbo (about 33 nautical miles) occupied five days. Continuing his journey he reached Hokat, a village of some importance—which has been occupied by 100 Gurkhas as a military police post, and is the furthest outpost of the British—on 30th December last, and found the river thus far navigable for light-draught vessels. The village is inhabited by Burmese-Shans and Kachins. Captain Rimmer proposes to continue his explorations up stream; from local information he is led to believe that the river is navigable for six days' journey further north, when it again becomes rocky and rapid.

The Frontier between China and Tong-king.—The delimitation on the maps of the frontier of Tong-king has been completed. On the north, the frontier line will stop 5 miles short of Mon-kaï. The islands of Gotho and all those comprised within the west of the meridian passing through the eastern point of Trako island are given to Annam. Those to the east of this line, belong to China. A part of the territory of Whang-Shupi, in Yunnan, is apportioned to China.—*Bul. Soc. de Géog. de l'Est*, 3^{e} *trime*, 1887.

The Navigation of the Mekong.—The French hydrographic mission to the Upper Mekong, having returned home, report (*Bul. de la Soc. de Géog. Com. de Paris*, tome x., No. 1) as follows:—The Mekong is navigable for several hundred miles; the rapids, which set a barrier to the tapping of the riches of the Laos provinces, do not present any dangers to navigation. During the whole of the season of high-water (three months in the year) vessels of a mean tonnage can

ascend the river as far as Stung-Treng. Cochin-China should thus become the entrepot of the produce of the Mekong valley.

AFRICA.

The Emin Pasha Relief Expedition.—Up to the present (21st February), we have received no news regarding the progress of Mr. Stanley later than what is contained in the published telegram from the Zanzibar agent to the London committee, which was received on 3d January last, and read as follows:—"Despatches from Emin passed Uganda 17th November. Gordon reports no news yet of Stanley. Stokes' messengers left Bugalda (*sic*) for Wadelai 6th November. Mwanga friendly." In reference to the telegram, Mr. George S. Mackenzie, the *interim* Secretary to the Relief Committee, says:—From the above it is not clear whether the despatches from Emin referred to have yet reached the coast. The news conveyed in this message has probably been brought down in the mail bag from the mission station at Uganda.

Mr. Gordon is the missionary who left Msalala early in August to take charge of the mission station at Buganda, vacated by Mr. A. M. Mackay.

Mr. Stokes left Zanzibar for Msalala early in October, and the messengers despatched by him referred to in this telegram are those sent by the Committee from the East Coast; and until they return it is scarcely likely we shall have any news *viâ* the East Coast direct from Mr. Stanley.

Origin of the name "Congo."—In *Petermann's Mitteilungen* (No. 1, 1888) Herr von Jankó, Jun., discusses this question. His conclusions are:—(1) That the Bakongo first gave the river this name, (2) that Bakongo means a man with a lance, and (3) that the river's name might mean "swift as a lance." He himself cannot say whether the river gave name to the tribe or the tribe to the river.—(*N.B.*—See review, in this month's Magazine, of the *Dictionary and Grammar of the Kongo Language.*)

Lake Mantumba.—At the end of last year, Mr. Bentley, on board the Baptist Missionary steamer *Peace*, explored Lake Mantumba. Since its discovery in 1883 by Mr. Stanley it is the first occasion of a European having visited it. Mr. Bentley's investigations do not support the supposed connection between this lake and Lake Leopold; on the contrary, Mr. Bentley thinks it more likely to be connected with the Chuapa and its affluent, the Bussera.

Gold Coast Colony.—From the latest Blue Book, which we have received from the Government of the Gold Coast, we gather the following particulars:—The area of the Gold Coast and Protected Territories are estimated at 20,000 square miles, the population being estimated at 651,000; no census has ever been taken on the Gold Coast, and there are difficulties in the way of doing so. The population to the square mile is 36·3135.—The Report contains a series of meteorological observations taken at Accra from February to December 1886.

Cameroons.—The scientific exploring expedition under Lieutenant Kund was disbanded on 7th November last at the mouth of the Kribi and reached Bongolo, the capital of Gumba, on the 19th November. The country traversed by the expedition was found to be entirely wooded and little inhabited. About 40 miles from the coast small settlements were met with. Bongolo itself lies in about 10° 50′ E. long., 2° 55′ N. lat., and about 700 feet above the sea-level; its surroundings being well-wooded heights, reminding one of the Black Forest. A place for the erection of the proposed observatory has not yet been selected, as the thickly wooded country appeared unfavourable for it.

The African traveller, Dr. Zintgraf, has left for the Rio del Rey, with thirty carriers, from whence he proposes to start for Lake Elephant, where he will erect an observatory. The other half of the expedition, under Lieutenant Zeuner, will navigate the Mungo in canoes as far as Mundame, in order to reach Lake Elephant from that side of the Cameroons territory.—*Deutsche Kolonialzeitung*, No. 4, 1888.

The French at Timbuktu.—Lieutenant Caron of the French Navy, on board the gunboat *le Niger*, has succeeded in reaching Korome, the port of Timbuktu. In this voyage, lasting three months, Lieutenant Caron passed beyond the limits attained by any of his colleagues, on the Upper Niger. From his account in the *Temps*, we learn that the gunboat left Manambugu,—which is situated about 24 miles below Bammako on the Upper Niger,—on 1st July, with a crew of six Europeans and eight natives. They arrived at Diafaraba (13° 50′ N. lat.) after thirteen days' sail, and shaped their course for Mopti, in order to enter Lake Debo by the Mahel-Balivel. They thus entered unknown country, and into the territory of Tidiani, the chief of the Masini, who rules over the right bank of the river. Tidiani, whose residence is inland at Bandiagara, is an opponent of French influence, and would not entertain the proposals of Lieutenant Caron, although he did not attempt to interfere with his liberty. Bandiagara is the most important centre of Mohammedanism. The village resembles a vast convent, prayers and religious manifestations being heard on all sides; but it would appear to be nothing but lip-worship. On the 31st July, after seven days' fruitless negotiations, the mission took leave of Tidiani and his counsellors, and returning to the gunboat embarked for Mopti. The river banks on this portion of their voyage were found to be uninhabited. They reached Lake Debo, after being detained for want of fuel, on 9th August. This lake, which is a magnificent sheet of water, has been explored and described by the traveller Caillé; beyond it the Niger assumes the name of Bara-Isa, and villages are numerous on the right bank. On the arrival of the expedition at Timbuktu, the town was found to be in a state of anarchy. Rhiaïa, the chief, at the instigation of the Tuaregs, had been for two years persecuting the ancient Jema, or association of merchants, and both he and the Moorish merchants were under the domination of the Tuaregs-Tademeket, who recognise Liuarlish as their chief. The expedition was coldly received, and took every precaution against surprise or treason. Rhiaïa, at the instigation of the Moorish merchants, declared that his country was not free, and that the French had no pretensions to it. The *pourparlers* with Liuarlish, chief of the Tuaregs, were equally without success; and the expedition in consequence returned without having accomplished the object of its mission.

River Falémé; Senegambia.—Captain Oberdorf, on his last journey of exploration, carefully examined the country lying to the south of the Senegal to the Futa Jallon. His itinerary made known the upper courses of the Gambia, the Falémé and the Bafing. The most important geographical result was the approximate fixture of the source of the Falémé. This river, according to present maps, rises from the Timbo plateau under the name of Tenné, but, according to M. Oberdorf, the Tenné is an affluent of the Bafing. The Falémé takes its source in the Koï. The river Bafing was found to be frequently obstructed for navigation.—*Bulletin de la Soc. de Géogr. de Marseille*, No. 1, 1888.

New Expeditions into Central Africa.—It is announced that Count Teleki and Herr von Hähnel intend to lead a large expedition, consisting of 400 armed

bearers, through Masai-land to Mount Kenia, and to push northward to Lake Samburu.

Bishop Parker, on his journey to Uganda, struck a new route from the East Coast to Usagara. He left Mombasa, crossed Usambara by a new way, and the river Ruvi at Kukomo, striking Mr. Last's route at Mgera, in Nguru, and continuing to Mamboia.

Count Joachim Pfeil's Journey in East Africa.—In the current number of *Petermann's Mitteilungen* (No. 1, 1888), Count Pfeil gives an account of his last journey (18th March to 8th May, 1887) in East Africa. A map accompanies the paper; the results, determined by observations, are tolerably secure in the regions of known latitudes, but open to question in other less known, or unknown, regions, on account of Count Pfeil's journey being accomplished almost entirely during the season of rains, when the heavens were constantly overclouded. Starting from Pangani, the traveller reached Mafi (5° 4′ S. lat.); visited the Mangu lake, and then explored the unknown parts from Useguha south to Mbuzini (6° 12′ S. lat.), about the longitude of 30° E. He then crossed the plains between the rivers Wami and Geringeri, following the course of the latter river, and often crossing it, to its confluence with the Kingani (below Usungula) and from thence, by both banks of the latter river, to Bagamoyo.

Having thus briefly sketched his route, we will refer to certain portions of his paper which may appear most useful for our purpose.

Count Pfeil calls attention to errors he discovered on Mr. Ravenstein's map, which have not been corrected by later maps. About 6½ miles north-west from Korogwe, following the Ruvu, one crosses the small river Mkomazi at Gereza. "In Mr. Ravenstein's map, this river is shown as flowing north and south through the Manga lake. Its point of junction with the Ruvu is also shown incorrectly." Following the course of the Mkomazi, a hill named Yermandia is shown on the map to the north of the Pasunga morass; it does not, however, belong to the range of hills called Vugiri, but stands alone, and nearer the Ruvu. Behind this hill, *i.e.* to the north, the Mkomazi flows between it and the Vugiri, keeping constantly to the foot of the latter. The river does not flow through the Manga lake, though the waters of the latter, during the rainy season, join the river. This outflow forms a canal. The surface of the lake, as also that of the Mkomazi, lies much lower than that of the Ruvu; from whence the fact is explicable, that although the Ruvu has an extremely sharp fall, the dirty light yellow water of the Mkomazi flows slowly and surlily. At Gereza the Ruvu reaches the level of the Mkomazi, and forces it to accompany its accelerated flow through its rocky bed.

Mountains or hills were only encountered on the left or north side of the Ruvu; on the right, or south side of the river, the land has only a gentle elevation. Vegetation is much stronger on the southern bank than on the northern. From the point at which he left the Ruvu (about 38° E. long.), to reach the Manga lake, the land rises to a ridge, from the top of which the traveller looked down into the valley, stretching between NE. and SW., in which the lake is situated. This valley is about four miles in length, and a little less in breadth. The lake does not appear to receive tributary waters, except those flowing from the neighbouring heights. A sandy shore bearing evidence of periodical immersions, surrounded the lake at the time of the traveller's visit; and, as already mentioned, a sort of canal on the SE. of the lake conducts the overflow of its waters into the Mkomazi. The water of the lake, like that of the Mkomazi, is greenish yellow in colour, although it holds in suspension so many alkalis as to

render it unfit for drinking. The depth of the lake is considerable; traces of crocodiles were discovered, but no fish were caught, although they are presumably there. There are no islands in the lake; round its margin there are bushes which offer a resting-place for the innumerable birds, ducks, geese, etc.; and the monotonous colour of the vegetation is relieved by the bright leaves of a plant resembling bananas. It is a very wild region, but seldom visited by natives, and there is no village for miles round. Of the remainder, and most interesting part, of his journey, Count Pfeil speaks very little, but no doubt he will publish his information elsewhere.

Arab Rising on Lake Nyassa.—We regret to learn that serious troubles have arisen between the natives and the Arabs at the north end of Lake Nyassa. From a private letter we have seen, which was despatched on 21st October from Bandawé, Livingstonia, it appears that the Wankonde natives had fallen into a dispute with the Arabs, the outcome of which was bloodshed on both sides. The Wankonde murdered twenty-nine Arab women, who were in their village buying food, and five men, and the Arabs have pillaged and burned all the Nkonde villages from Mpata to the Lake. The Wankonde have all fled to Ngerenge, the village of Chungu, on the Lufira, and close to the lake, leaving the Arabs in possession of the country. The latter assert they mean to hold what they have secured, and that the people who return will require to pay tribute to them—the white men, if they remain, not being exempted. More fighting may possibly have taken place. Meantime, Consul O'Neill, Consul Hawes, and Mr. Fred. Moir went to Karonga, in the *Ilala*, and relieved the agent of the African Lakes Company, and the Rev. Alex. Bain, who had been obliged to take refuge within a stone fort or stockade, and to observe a strictly neutral policy. Since then, the latest news that has reached this country was, according to our informant, a telegram, which briefly stated: "Nyassa route closed."

AMERICA.

Venezuela and the British Guiana Boundary.—In regard to the Venezuela boundary question, which has been open for nearly half a century, Her Majesty's Government have finally taken action. The following proclamation has been issued (*South American Journal*, 4*th Feb.* 1888) by Mr. Charles Bruce, Lieut.-Governor of British Guiana:—"Whereas it has come to the knowledge of the Government of British Guiana that certain concessions have been granted by the President, and by and with the sanction of the Government of the United States of Venezuela, purporting to give and grant certain rights and privileges for constructing a railway to Guacipati, and in and over certain territories and lands within and forming part of the colony of British Guiana: Now, therefore, I do hereby intimate to all whom it may concern, that no alleged rights purporting to be claimed under any such concession will be recognised within the said colony of British Guiana, and that all persons found trespassing on or occupying the lands of the colony without the authority of the Government of this colony, will be dealt with as the law directs."

The Sources of the Orinoco, Venezuela.—On the 18th November last, under the Presidentship of M. de Lesseps, a meeting of the Paris Geographical Society was held to welcome home M. Chaffanjon, the explorer of the sources of the Orinoco, the text of whose address is given in the Society's *Compte Rendu*.

M. Chaffanjon compared the basin of the Orinoco to that of the Seine, the

extent of which is about six times less. The volume of the waters of the Orinoco equals twenty-four times that of the Seine, the rainfall being four times greater. The chief interest of M. Chaffanjon's voyage commences on leaving Ciudad Bolivar. He described the geography of this region (which may afford material for a subsequent paper in this Magazine), and the manners, customs, and languages of the different peoples visited by him. To the last mentioned he gave considerable attention : all the idioms are different, but, in his opinion, they have a common origin.

Leaving San Fernando, the recital of his voyage in the unexplored regions is particularly interesting. The rivers offer curious phenomena in erosion. He followed for some distance the Rio Cassiquiare, an arm of the Orinoco, which unites the basin of the latter with that of the Amazon, by the Rio Negro. For some time he lived in the midst of the Macosa and Maquiritare Indians, and he gives some interesting information in regard to them. The mountainous region commenced on leaving the Rio Mavaca, and travelling became difficult. In this region, which is inhabited by the reputed cannibals, the Guaharibos Indians, he met with many adventures, though he experienced nothing to justify their evil reputation. With only two Indians he set out alone to discover the sources of the Orinoco, which there is but a rivulet ; he crossed several rapids, and after seven months' navigation, and much privation and fatigue, he arrived on 18th December 1886 at the sources of the river in the Sierra Parima.

Exploration of the Chaco, etc.—The Paris Geographical Society has received a telegram from M. Joseph de Brettes, who has been intrusted with a mission by the Minister of Public Instruction, informing it that he has recommenced his travels through the Chaco and the central region of South America. M. de Brettes started about a year ago from France with the intention of following up a journey which he had begun a short time before, and of passing through the triangle in South America which is bordered by civilised and inhabited countries. Business relations between all these countries are very difficult to maintain, as the centre of this triangle is occupied by an immense extent of territory which has never been surveyed, and over which there are no routes or roads. This territory is called the Chaco, and is sub-divided into the Northern, the Central, and the Southern Chaco, all three of which are inhabited by savage Indian tribes. Several efforts have been made to penetrate into the two former by water, and it will be remembered that Dr. Crevaux perished three or four years ago while following the course of the Rio Pilcomayo. Other travellers have reconnoitred the course of the Rio Vermejo ; but it is generally agreed that these two streams are not navigable in their entire length, so M. de Brettes resolved to try the land route through the Southern Chaco. His first journey was commenced in 1885, when, going up the Parana River from Buenos Ayres as far as Corrientes, he endeavoured to reach the town of Candeliard, upon the opposite coast. The distance was 700 miles, and M. de Brettes started with a caravan, consisting of two Indians and sixteen horses. When he had got 200 miles inland he came upon an immense salt lake 116 miles long, and convinced himself that the land route was practicable. But upon the forty-third day of his journey he was struck down by fever, and had to return to Corrientes. His illness having left him almost without resources, he determined to come home, and endeavour to interest the Geographical Society in the work. This he succeeded in doing, and though, like M. Douls, he is only twenty-five, he is now making his second expedition to this unexplored region.—*South American Journal*, 21*st January* 1888.

AUSTRALASIA AND OCEANIA.

New Guinea.—We have received the *Proceedings of the Victorian Branch of the Royal Geographical Society of Australasia*, vol. v. part. II., containing *in extenso* Mr. W. R. Cuthbertson's report of his journey to Mount Obree in New Guinea, and are much struck by the proofs of energy and resource, as well as by the tact and temper, shown by him in his dealings with the natives. He gives, *inter alia*, the genera of the plants brought back from different elevations, from which we gather that even above 6000 feet very few Alpine or specially sub-Alpine plants were found, besides rhododendrons, and probably certain ferns. We regret again the shortness of time at his disposal. "Time and confidence," as he says, are absolutely necessary in dealing with such people as these natives ; the new seeds, for instance, which he left with them may perhaps come to nothing from their dislike to adopting new food. Our officials in Fiji find the same difficulty. Even the cassava (manioc plant) introduced there, which, besides being more nutritious than the yam or taro, has the great advantage, to a lazy people, of being grown without trouble, finds very little favour.

Mr. Cuthbertson notes that the tribes he met with have only the spear and shield, and not the bow and arrow which is the more characteristic Papuan weapon. The men not only remove all the hairs from their face, but shave the top of the forehead, which no doubt gives the appearance of a high forehead, observable in their photographs.

A curious instance of superstition was shown by his companions refusing to eat a kangaroo, killed by his dog, because it was killed in an enemy's country ; and he gives an amusing proof of their simplicity in collecting his candle-ends, and sowing them to ensure a future supply ! We are at last on the track of the tailed men who, when they sit down, make a hole in the ground for the stump, for they live in a mountain seen by the writer to the north-east of his route. The syllable *goro*, which terminates so many of the names given in the report—Kiregoro, Hopogoro, etc.—is no doubt the Fijian "Koro," a town or village.

Sufficient details are not given to enable a judgment to be formed on the subject, but it would appear probable that auriferous deposits exist on the route traversed. We note that the height he gives for Mount Obree, which differs so materially from the Admiralty calculation (see *Magazine* for January 1888, p. 57), was taken by boiling-point thermometer.

Louisiade Group.—At a meeting of the Victorian Branch of the Royal Geographical Society of Australasia, held on the 21st December, a paper was read by the Honourable John Douglas, C.M.G., High Commissioner of British New Guinea, describing a recent cruise in the Louisiade Group, which extends to the south-east of New Guinea. The labour traffic, which has been stopped in the Protectorate, still continues in these islands, and various disturbances had lately resulted therefrom, the Calvados group being now unpeopled. At Johannet Island, the scene of a recent massacre, plenty of pearl shell was seen in the clear water, but at a great depth. Newston, as the entrance to the Louisiade Group, is rapidly becoming a resort of traders, but the navigation at that point is very intricate, as it is at Sudest Island, where, however, beautiful pasture was found, much finer than on the adjacent (New Guinea) mainland. Here they landed some returned labourers, and were well received. Rosset Island, their furthest point, is reported as steep and mountainous, and covered with dense forest.

Mr. Douglas testifies to the great value, in the interests of peace and civilisation, of the labours of the missionaries, yet he considers the natives unable to

comprehend religious doctrine. It has been explained to them, however, that they are no longer at liberty to kill one another, and they are glad to accept our protection even on these terms.

Newly-discovered Island.—The Government of Batavia have informed the British Admiralty that the Dutch warship *Samarang* has discovered an island not marked on our charts, to the west of Timor Laut. Its position is stated to be in 8° 15′ S. lat., and 130° 39′ E. long. It is two miles long, nearly one mile broad, and is flat and wooded.

Saipan : Caroline Islands.—Mr. Alf. Marche, who has been exploring the Caroline archipelago, has sent to the Paris Geographical Society a short account of his work. He traversed Saïpan in every direction without finding a single trace of volcanic action. The highest elevated peak, Tapochao, attributed to be 2000 odd feet, he found to be only 410 metres, and the other mountains did not exceed 190 to 220 metres in height. They form a chain which, starting from the west, and interrupted transversely by Mount Tapochao, stretches to the north of the island. At the commencement of this century the island was populated by inhabitants of the Carolines, sent there by the Spaniards, and some Chimeros.

ROUTES, RAILWAYS, CANALS.

The Congo Railway is progressing. It was hoped that it would reach Leopoldville before the end of February.

M. George Angeli, having recently returned from a journey in the Western Sahara, speaks of a projected railway from Cape Juby, facing the Canary Islands on the West African Coast, direct to Timbuktu and the Niger. He has, he states, obtained concessions from the chiefs of the Sahara and Sudan.—*Bulletin de la Soc. de Géog. de Marseille*, tome xii., No. 1, 1888.

The Maniteb Canal.—The *Volkswirtschaftliche Wochenschrift* states that the Russian Government have at present under their consideration the project of canalising the Maniteb River, and effecting a water communication between the Caspian and the Sea of Azov.—*Chamber of Commerce Journal*, 5th January 1888.

Brazil.—The long sought-for uninterrupted trade route between Brazil and Bolivia appears to have been discovered at last to be in the Rio Purus. Colonel Labre, who reached Bolivia by the Madeira and its tributary the Madre de Dios, made his return by the Acre or Acquiry, a tributary of the Purus, without any hindrance from rapids or other difficulties.—*Economiste franç.*, 1887. No. 50.

M. Foureau is about to undertake a journey into the Tuareg country, with the object of investigating the practicability of the proposed trans-Saharan railway. He will make the journey alone. Having for the past three years carefully prepared for this enterprise, mixed with caravans, and traversed a large tract of country in the neighbourhood of the Tuaregs, he is confident of success.

Projected Maritime Canal across Italy.—The Italian Government have under consideration a project for canalising the Calabrian Peninsula across the province of Cantanzaro, in order that vessels may avoid passing through the Straits of Messina, or between Malta and Sicily. The length of the proposed canal would be 60 miles from the mouth of the Amato River, in the Gulf of Santa Eufemia, to that of the Coraco, in the Gulf of Squillace.—*Bull. Soc. de Géog. de l'Est*, 3e trimestre, 1887.

New Route from Minneapolis through Canada.—The lines of railway from Minneapolis and Daluth have been completed through Northern Michigan to the Sault Ste. Marie, connecting there with a branch of the Canada Pacific, thus opening up the shortest route to the eastern markets, *viâ* the Canadian route. The distance from Minneapolis to Boston, *viâ* the Canadian Pacific, is 39 miles shorter than by any other route. From Minneapolis to Portland, Me., the distance is shortened by 150 miles; from Minneapolis to Montreal the distance is shortened 200 miles; to Halifax the new route is 250 miles shorter than by the Grand Trunk and Intercolonial; and to St. John 400 miles shorter. From Daluth to Boston the distance is shortened 200, and to New York 150 miles.—*Halifax Mail*, January 13.

Canal Project in Brazil.—The old project of a canal from the Lagoa dos Patos through the lagunes on the Atlantic seaboard has been revived and extended by Dr. Edwardo de Moraes, who proposes a canal 190 miles long from the port of Laguna, in the province of S. Catharina, to the Lagoa dos Patos. The route suggested is from Laguna to Aracangua, to Mampituba, to Lagoa dos Barros, to Lagoa dos Patos; and the cost of construction is estimated at twelve million *reals* per kilometre (1 kilometre=1094 yds.). Dr. Moraes proposes to found a company, and has obtained the sanction of the Government to open the canal. The minimum depth is to be one metre (3·282 yds.), the width 5 metres, and along the canal it is proposed to lay a telegraph or telephone line. —*Deutsche Rundschau*, February 1888.

MISCELLANEOUS.

Lord Dufferin, in December last, opened the new **Railway Bridge over the Ganges** at Benares.

M. A. Thouar has again successfully crossed the **Gran Chaco**. Details of this second expedition have, however, not yet come to hand.

M. Venukoff announces the discovery in the north of Saghalien of abundant springs, if not entire lakes, of **Naphtha**.

Earthquake tremors were last month experienced on the west and north of Scotland and in other parts of the world.

An expedition to **Babylon** and **South Mesopotamia**, under the auspices of the University of Pennsylvania and a special committee, is preparing to start at the close of next summer.

The **Northern Boundary of the Province of Sante Fé** has been fixed by the Argentine Congress to be in about 28° S. lat., and encloses a considerable portion of the Gran Chaco.

Following up the explorations of Lieut. Castillo in **Southern Patagonia**, Dr. Sorondo proposes to pass the winter on the slopes of the Cordilleras. The expedition is to last ten months.

A Commercial Museum has been established at **Tokio** in connection with the School of Commerce. The Japanese authorities hope by this means to familiarise their merchants with the products of foreign countries.

We regret to have to announce that **Mr. Montagu Kerr** has been obliged to return to Egypt to recruit his strength, he having been attacked by a fever when about to start on his adventurous expedition from the East Coast of Africa.

A new expedition to **Togo-land**, under Dr. Wolff and Lieut. von François, the latter acting independently, has started from Germany. The object of these expeditions is to explore the interior of Togo-land, and to erect stations for scientific observations.

To the current Bulletin (No. 4, Vol. xix.) of the American Geographical Society, Dr. Konrad Ganzenmüller, of Dresden, contributes a very suggestive and useful paper on **Geographical Nomenclature**, and gives several examples of the derivation of place-names.

Dr. Colin, who made a journey into the **Western Sudan** in 1883-84, left last October for the same region. He proposes to explore the upper course of the Falémé, to descend the Bafing to Bafulabé, and to establish a trading station on the upper Bambuk.

At a recent sitting of the Geographical Society of the Pacific, Professor Davidson reported that his investigations into **Ocean currents** have led him to the conclusion that a branch of the warm-water current of Japan, the **Kuro-Sivo**, passes into the Arctic Ocean by the Bering Strait.

According to a series of deep-sea soundings carried out by the Norwegian Hydrographic Office, it has been found that the great fishing banks near the **Lofodden Isles** extended far more to the west than in the report given of them by the Norwegian North Sea Expedition.

M. Merensky writes to the *Deutsche Kolonialzeitung* that Mr. J. S. Moffat, British Commissioner for **Northern Bechuanaland**, has received orders from Cape Town to visit Lobengula, king of the Matebeles, to ask him to accept British protection.

Colonel Gallieni and Commander Vallière left Bordeaux last October for Dakar. This year Colonel Gallieni will make a careful exploration of the region situated between the Falémé and the **Upper Niger**. The French authorities hope to open up commercial relations with the large populations of this region. To Bafulabé, an important industrial centre, Colonel Gallieni hopes to bring the railway during the dry season.

General Tillo has recently published a pamphlet on the distribution of temperature and atmospheric pressure on the surface of the globe. The result of his investigations is that the mass of the continents together is 3° C. colder than the oceans, and that the New World is 3° C. colder than the Old World. The Atlantic Ocean he found to be 2°·6 C. colder than the Pacific. The mean annual temperature of the northern hemisphere is equal to 15°·45 C.

M. Soller returned to France last year, after having penetrated certain regions hitherto unvisited by Europeans. His journey by an indirect route to **Marocco** does not call for comment. He subsequently reached the Wed Nfis and entered a region in the Atlas mountains hitherto unexplored ; then, ascending the river, he penetrated the mysterious region of Sus, which is closed so hermetically on strangers. Striking west, he reached the Ida or Tanan people, and finally visited the Tiris desert, to the north of Senegal.

M. Jules Girard, in the *Revue de Géographie*, July and August 1887, discusses **the Distribution of Temperature on the Surface of the Globe** with the object of showing that "the theory of the distribution of heat does not accord with the temperature corresponding to the degrees of latitude." His paper presents alternative theories, and a method of distribution which can only be

tested by actual observations. The tables of monthly means from the least known points are completed by a bibliography, including a great number of works on local and international meteorology.

NEW BOOKS.

Emin Pasha in Central Africa. Being a Collection of his Letters and Journals. Edited and annotated by Professor G. Schweinfurth, Professor F. Ratzel, Dr. R. W. Felkin, and Dr. G. Hartlaub. With two Portraits, a Map, and Notes. Translated by Mrs. R. W. Felkin. London: George Philip and Son, 1888. Pp. xxviii., 547. *Price* 16*s.*

Our readers require no introduction to Emin Pasha. The present volume contains a most valuable collection of his letters, journals, and papers—many of which have already been published—which were written by him during the ten years of his administration of the Egyptian Equatorial Province. Happily, there are very few breaks in the narrative of his life and labours: they present, perhaps, the most valuable and comprehensive work we possess on the district in question. As a sequel to Dr. Schweinfurth's *Heart of Africa* and the published accounts of former travellers, and as an introduction to the volume of travels now being prepared by Dr. Junker, the present book must be considered almost indispensable.

Dr. Felkin contributes an admirable introduction, in which is explained the object and scope of the work, the present and the past condition of affairs in the basin of the Upper Nile, and some interesting details concerning Emin Pasha. Mr. Ravenstein's map will be appreciated, though it is designed to serve merely as a provisional sketch to illustrate Emin Pasha's journeys; and his glossary and index will be found extremely useful. His work in reducing to a uniform system the orthography of native names and places also deserves notice. As an appendix, we have notes by the various editors explaining obscure or technical passages in the book. The translation by Mrs. Felkin deserves also to be favourably mentioned.

In all his journeys Emin Pasha sank every consideration of scientific research—towards which he felt so strongly drawn—before his duties as the administrator of a distressed and disunited province, left on his hands by an effete government who had abandoned him and his garrisons when the Sudan was lost to them. To control the government service, to inspect the officials and work accomplished, to protect the Negro population, were the chief objects of Emin's numerous excursions from his head-quarters. But on the way and in camp, when time admitted, he gave all his attention to scientific collecting and investigations: passing through a district, he inquired into the tribal divisions, customs and qualities of the natives; its geography, zoology, botany, etc. Thus, all the natural sciences have been enriched by his work. Our very incomplete knowledge of even the animal life of Central Africa does not admit—in the opinion, at least, of Emin Pasha—of generalisations being made. But Emin has, beyond any other explorer of those regions, collected material which will serve as a basis for a general survey. He has, moreover, made many new discoveries; and, when all his collections have been thoroughly examined, they cannot fail to prove of very great value indeed. Emin's district is specially interesting to the explorer as forming a sort of neutral ground—at least, between the lakes—on which representatives of

different zoological regions meet. "If we go westwards," he says, "the West African type of fauna and flora becomes continually more prominent; if we go eastwards we meet the well-defined forms of the southern Somal district, and more isolated instances of the forms of the southern half of tropical East Africa. . . . Wallace has defined the zoological provinces of the African continent with a master hand, and, on the whole, there is nothing to alter or find fault with. . . . As a result of all the facts now collected (however), the limit of Wallace's 'West African sub-region' must be pushed very considerably to the east." The whole river-valley of the Bahr-el-Jebel up to the Albert Lake must be included in the dominion of the steppes—but wooded, not sandy, steppes. The further we go from the river westwards the more perceptible does the transformation become, the more striking the resemblance with the sandy plateaux and steppes of the Somal country. The whole Langó district may be compared to certain tracts of Kordofan, which contain scattered, bare mountain-tops, sandy steppes, reservoirs of water, and a nomadic population. The main lines of demarcation in the whole of Emin's territory, both for the vegetation and the fauna, run nearly from SE. to NW., and the purely southern forms extend further northwards in the west than in the east. The flora naturally harmonises with the fauna, and as the western and southern varieties of plants penetrate much further northwards than has been supposed, corresponding animal species will go with them.

The geographical and ethnographical notes which Emin Pasha gives in his letters and journals are of the highest value, and his labours in comparative philology will be appreciated by Dr. Cust. All our maps of the basin of the Upper Nile, especially to the west of the river, are incorrect. Emin Pasha himself supplies information of a negative rather than of a positive kind in regard to the correction of positions, and we must wait for the appearance of Dr. Junker's map before doubtful points can be at all settled. In regard to the much-vexed Welle problem, Emin Pasha makes several allusions (pp. 186 *et seq.*, and 434 *et seq.*) which will help to confuse the student.

Our space will not admit of our following Emin in his interesting journeys. He broke much new ground, and he has corrected the reports of some previous travellers. He states that the Akka—who correspond to the Bushmen of the south—have neither lances nor spears, but make exclusive use of the bow and arrow, and that the so-called Akka lances which have been sent to Europe are either the long Mabode or the short Momvu weapons. We can only refer the reader to some striking passages in the book. On page 223 will be found some curious facts about lions; on pages 339 and 340 a novel use of serpents; on page 304 a most graphic account of a negro dance; on page 272 the most uncomfortable (Shuli) mode of salutation we have yet heard of; on page 303 a Nyambara dance, etc. It was to be regretted that on his journey from Labore to Fatiko, whilst on a tour of inspection in the south, pressing duties prevented his entering the *terra incognita* to the east of Fadibek. Most interesting accounts are given by Emin of his relations with Unyoro and Uganda, and his descriptions of the peoples and their rulers are among the best we have seen. It is worth noticing that he found Kabréga to belie the bad character attributed to him by Baker. To the geography and ethnology of Monbuttu—first discovered by Schweinfurth, and explored by Junker and Casati.—Emin contributes some striking facts, and his chapters on civilisation and politics represent a new link in the history of the Sudan, and an unqualified testimony against Egyptian misrule. His remarks on the slave-trade, which he himself suppressed in the old *mudirië* of Rol, deserve the attention of our statesmen.

We reluctantly leave the inexhaustible topics which this book naturally suggests. It is so full of new matter, and of old matter made new, that only a perusal can adequately impress one with its merits.

Der Sudan unter ägyptischer Herrschaft. Rückblicke auf die letzten sechzig Jahre, nebst einem Anhange: Briefe Dr. Emin Pascha's und Lupton-Bey's an Dr. Wilhelm Junker, 1883-1885. Bearbeitet und herausgegeben von Richard Buchta. Leipzig: F. A. Brockhaus, 1888. Pp. 228. [Index, two Maps, and three Portraits.]

This book is confessedly published in response to the great public interest which, at first directed towards Emin Pasha, faithful to his trust, holding his province for the good of his people, has now centred on the expedition sent to his relief. It is a welcome addition to the literature dealing with the most recent phases in the history of the Sudan, and Herr Buchta deserves credit for the admirable manner in which he has accomplished his task. He tells the story of the Sudan with a simplicity and directness that comes of a thorough mastery of his subject. In the opening chapters he narrates the earliest events in the history of the Sudan, from the time it first attracted the notice of Europeans to the new era of things instituted by Ismaïl Pasha. Gordon's operations in the Sudan and those of Sir Samuel Baker are treated at considerable length, as also are Gessi's campaign against Zebehr, Hicks Pasha's disastrous expedition, and the causes that led to the rise of the Mahdi and his Emir, Osman Digna. A number of letters from Emin Pasha, Governor of the Equatorial Province, and Lupton Bey, Governor of the Bahr-el-Ghazal, are inserted as an Appendix. They tell of the events during the Mahdist movement and the fall of Khartum, of the surrender of Lupton and his subsequent captivity, and of the brave stand made by Emin and his followers against the Emir Karamallah and the Mahdi hordes. A number of original Arabic documents and extracts from Dr. Junker's journal supplement these letters, and, being published for the first time, add greatly to the value of Herr Buchta's narrative. The whole forms a connected account of the events which led to the loss of the Sudan and the despatch of the expedition under Stanley for the relief of the only Egyptian official who has been able to hold the post intrusted to him by General Gordon.

Im Innern Afrikas. Die Erforschung Des Kassai, während der Jahre 1883, 1884, und 1885. Von Hermann Wissmann, Ludwig Wolf, Curt von François, Hans Mueller. Mit einem Titelbild, über 100 Abbildungen und 3 Karten. Leipzig: F. A. Brockhaus, 1888. Pp. xix., 457.

The important results obtained by the expedition under Wissmann in determining the hydrography of the southern basin of the Congo, and more especially in tracing to its confluence the mighty affluent of the Kassai and its tributaries, are now world-known. In our *Geographical Notes* we have given from time to time the news which reached Europe of the discoveries and investigations of this expedition. To these reports we must refer our readers, for it would not be possible, within reasonable limits, even to briefly summarise the mass of new information which is contained in the present account of the work performed by the explorers. It will be sufficient, in order to indicate what was actually accomplished, merely to exhibit the map of Central Africa, before the expedition started—showing the unexplored territories to the south of the great bend of the Congo, and to place beside it the intricate network of rivers now traced to their confluence and the surrounding country fairly well explored, as shown

in the maps of the present day. To Lieutenant Wissmann and his colleagues we owe by far the greater part of our knowledge of these river systems.

In company with Dr. Pogge, in 1879-82, Wissmann had already performed a journey in the southern basin of the Congo, crossing the Kassai, Sankuru, and Lomami. At the time he started on his second expedition to the same region it was supposed that these rivers were tributary to the Congo, but the information in regard to them was based merely on reports. Livingstone had, however, considerable knowledge of the ultimate course of the Kassai. "The Kassai," he said, "subsequently takes the name of Zaire, turns to the north-west and west, and flows, under the name of Congo, into the sea at Banana."

On his return home, after crossing the continent of Africa, Wissmann was intrusted by the King of the Belgians with the organisation and leadership of this great expedition to the Kassai. He had left Dr Pogge behind him, and besides having an earnest desire to bring relief to him—for disquieting news of his safety had reached Europe—Wissmann was anxious to continue his explorations. He organised one of the largest expeditions, if not the largest, that had hitherto been led into the interior. Himself an officer in the German army, he selected as his colleagues four brother-officers: Dr. Ludwig Wolf, Lieutenant Curt von François, and Lieutenants Franz and Hans Mueller—all of whom undertook detached missions and scientific explorations. The expedition was armed with 500 guns and a Krupp of special construction; it was provided with a steel-boat in 16 sections, and it marched under the German flag.

Briefly stated, the route taken was from Hamburg to Cameroons, and from thence to St. Paul de Loando—to Malangé—to the Kuango—to the Kassai—to Mukengé—and down the Lulua and Kassai to the Congo at Kwa-mouth (or rather, Kassai-mouth), and Stanley Pool. Dr. Pogge was unexpectedly met with at Malangé, but, unhappily, died on his way home. In September 1885, Wissmann himself was obliged to hand over the conduct of the expedition to Dr. Wolf and proceed to Madeira to recruit his shattered health. Dr. Wolf had already made a thorough exploration of the Sankuru and its tributaries, and his other work deserves high commendation.

Various excursions made by Wissmann's colleagues from the main line of route taken by the expedition were carried out with success. Mueller reports on his journey to Muata-Kumbane, von François on his excursion to Mona-Tende, and Dr. Wolf supplies an admirable and very complete account of his visit to the warlike Bakuba and their southern neighbours (to whom they are not, however, kin) the Baluba. The high degree of culture obtained by the Bakuba is most strikingly demonstrated by Dr. Wolf. They seem to have migrated from the NE., whilst the Buluba came from the SE.; and, by their own account, they occupy a territory of considerable extent. It was whilst living with these people that Dr. Wolf first heard of the Sankuru, the correct course of which to its confluence with the Kassai (as was afterwards discovered) was sketched out to him by a native.

In Chapter vii. of the book we have a useful summary of the general geographical and physical features of the country from the coast to Mukengé, which for some time was made their head-quarters. It was at this spot that Wissmann was obliged to espouse the cause of the ruler, Kalamba, against his chief, Katende, who had refused to pay the customary tribute. His party supported the army that was despatched to exact the tribute, and, in consequence, secured for Kalomba a bloodless victory that would not otherwise have been obtained. Katende was taken prisoner and handed over to Wissmann, who subsequently re-instated him.

The expedition had many trying experiences, through which it came with credit. Franz Mueller died of fever, and other members of the expedition were lost. A sharp fight on the Kassai with the Bassango-Mino was, however, the only occasion on which serious obstruction was met with.

Lieutenant Wissmann is to be congratulated on the complete success of his expedition. The portly volume in which the record of its work is recorded will for many years be an invaluable book of reference, and it deserves to be translated into English for the benefit of those who do not read in German.

Numerous illustrations—some, we must confess, but poorly executed—add greatly to the worth of the book, and the maps that accompany it are of importance.

Dictionary and Grammar of the Kongo Language. Compiled and prepared for the Baptist Mission. By the Rev. W. Holman Bentley. Trübner and Co., 1887. 718 pp., with Table of Concords.

For five years, amid fever and blindness for a time, the brave and accomplished missionary who began his African work in the Cameroons, has given himself to the preparation of this scholarly and most useful book. The philology we do not touch. But the author's preface, preceded by an Introduction from the pen of Mr. Robert Cust, LL.D., Honorary Secretary to the Royal Asiatic Society, has not a little geographical interest. The name of the great river, which includes nearly all the western half of Equatorial Africa, is derived from the ancient and powerful kingdom of Ekongo, whose capital was Mbanza Ekongo, which appears as Ambassie on old maps, 150 miles from its mouth. It seems to mean the river of the hunter, from *Nkongo*="a hunter," or *konga*="to gather large fruit." The natives themselves call it *Nzadi*="the great river," which the earliest European travellers corrupted into Zaire, a name which may now be dropped. The natives are called Mwixi-Kongo (pronounce *x* as *sh* or "people of Kongo"; *xi*=*nzi*="a country.") They are of the great Bantu race, which holds all Africa south of the fifth parallel of N. latitude, except the spots from which the Hottentot-Bushmen of the Cape are disappearing. A line from the Cameroons mountain, drawn to the east coast parallel with the equator, is the northern ethnical frontier of the Bantu. The Kongo language is spoken in its perfection at San Salvador, the ancient capital, now in mouldering ruins, which once dominated West Africa. It takes its place by the side of the Swahili, the Zulu, and the Pongwe. Our own Scottish scholar and missionary, the Rev. Dr. Laws, has done very much the same work for the speech of the Nyassa tribes, and he and Mr. Bentley found not a little common to the two. This work is indispensable to the traveller in West and Central Africa, and to the missionaries and scholars who seek to study the many varieties of the Bantu peoples, who have in many respects a finer nature and higher possibilities than the Negro family.

Richard Burton, K.C.M.G.: His Early, Private, and Public Life, with an Account of his Travels and Explorations. By Francis Hitchman. 2 Vols. London: Sampson Low, Marston, Searle, and Rivington. *Price* £1, 16*s.*

Writing a biography of Sir Richard Burton is almost like making a survey of the ground that has been covered by recent geographical discovery. The story is written in full in the eighty and odd volumes that themselves form the best monument of the untiring energy of this "path-finder" of science and civilisation. As, however, the bibliography of Burton's works is itself something that is grow-

ing to be of cumbrous length, there is a service rendered in condensing, as Mr. Hitchman has done, the tale of his travels and explorations in all zones and continents into two volumes. Sir R. F. Burton has been fortunate above many who have done wonders with the pen and with the sword, first in having his biography written and published in his lifetime, and under the survey, and with the collaboration, of his wife; and, secondly, in having so enthusiastic and admiring an annalist as Mr. Hitchman. The work, not an easy one, of epitomising the wanderings and labours of Sir R. F. Burton in India, in Arabia, in Somali-land, in Central and Western Africa, in Brazil, in Iceland, in Syria, and in a host of other regions, is extremely well done; which praise, however, is not to be understood as covering acceptance of the views set forth by him, and accepted by his biographer, on the numerous controversial points, personal and scientific, which emerge in these volumes. More interesting than any of the other interiors which Sir Richard Burton has helped to make known to us—than the narrative of the discovery of the sources of the Nile, or of the penetration of the mystery of the "forbidden city" of Harar, or of the "Kaaba" itself—is the revelation made of his own character, and habits of mind and life. This, illustrated chiefly by incidents from his early life, we have in chapters contributed by Lady Burton, and written with an originality, vigour, and candour that are worthy of the subject and of herself. Burton is able to lay claim to a "curious commingling of English, Scotch, Irish, and French blood in his veins"; the Scottish blood is that of the Macgregors, and "whether there may be also a tinge of Arab, or perhaps of Gipsy blood, is perhaps open to question." An affirmative answer on the point would, on grounds of heredity, explain much, and give significance to these remarks by a friend, quoted by Lady Burton with approval:—

"Richard Burton's talents for mixing and assimilating with natives of all countries, but especially Oriental characters, and of becoming one of themselves without any one doubting or suspecting his origin, his perfect knowledge of their languages, names, customs, habits, and religion, and last, but not least, his being gifted by nature with an Arab head and face, favoured his first great enterprise. One can learn from that versatile poet-traveller, the excellent Theophile Gaultier, why Richard Burton is an Arab in appearance, and account for that incurable restlessness that is unable to wrest from fortune a place wherein to repose when weary with wandering, like the desert sands."

Gaultier's explanation points to Atavism—to the "mysterious voice of blood which, silent for generations, speaks at rare intervals a more intelligent language," as of some forgotten ancestor asserting his rights. The Arab or Gipsy ancestor of Burton spoke at a very early age, and has continued asserting himself ever since, until now, when, as one learns with regret and sympathy, his wandering days and his labours with pen and sword are nearly over, and, in the words of his wife, "the State"—to which he has given nineteen years of military and twenty-six of consular service—"has had the last ha'porth of work out of Richard." Most remarkable among his personations of "Oriental character"—most marvellous indeed of his many marvellous adventures—was his journey, in the disguise of a Hadji, to Medina and Mecca. The narrative, pretty fully given, reads as freshly and forcibly as on its first publication; and, indeed, comparatively little had been added since his visit to our knowledge of the "Holy Cities" of Islam. Scarcely less audacious and dangerous was his excursion to Harar; but here we begin to tread among the gins and pitfalls of geographical controversies, and to come especially upon the "old old story" of Burton's rela-

tions with his early companion, Speke—and much more of the same thing is found in the account of his journeys to Lake Tanganyika and the Nile sources. Nearly half of the second volume is taken up with West African studies, and in particular we have descriptions of residence at Fernando Po—a consulate "divided by the thinnest of party walls from Anti-Paradise,"—his excursions to the Cameroons and Gaboon rivers, and his remarkable experiences as ambassador to Gelele, of Dahomey, during the "Customs," when he so far "assimilated himself" with native habits as to "dance before the King."

"Fastidious Englishmen," we read, "might perhaps be disposed to object to the spectacle of an ambassador and a naval surgeon capering to the music evoked from an accordion by a Methodist nigger, but Burton knew the people he had to deal with, and put the topstone on his popularity by showing that he could dance as well as the king, besides doing a host of things, such as writing, drawing, and using a sword."

Demonstration is made of Sir Richard's vigour and thoroughness of action, and outspokenness of speech, in the chapters describing his visit to the Pacific States, his consulate in Brazil, his many varied, and often exciting, experiences while subsequently representing his country at Damascus and Trieste, and his excursions, made in times of leisure, to Iceland and the Gold Coast, Midian and India. The sum of Sir Richard Burton's work as traveller and explorer is marvellously great for one man to have performed; but we know that it has only taken up a part of his restless energies, and that he has made wide excursions into other and special tracts of literature and research,—exploring, for example, the archæology of the "Sword," and translating the "Lusiads" of Camoens, and the "Thousand and One Nights,"— and has brought back, and is still collecting, rich spoils. The "Life" of Burton is almost as interesting as the man.

Whitaker's Almanac for 1888.

This useful annual appears after twenty years of publication as well edited as in former years. Unlike most other almanacs, it contains numerous well-written articles upon topics of interest. For example, this year's Almanac has an article on the Forth Bridge, followed by details of some of the largest railway bridges in the world. It contains, likewise, the usual retrospect of geographical progress during 1887. There is an article on Her Majesty's diplomatic and consular services, and another on German trade and German competition. In the latter we are reminded that "the expansion of the German export trade has for some time past been a subject of frequent discussion." Taking the period from 1875 to 1886 the article shows that the annual exports of Germany averaged £145,224,000 and those of the United Kingdom £216,935,000. The exports of 1886 were 2·8 per cent. above the average in the case of Germany, and 2·1 per cent. below the average in the case of the United Kingdom. It is not so much, however, as regards the increase of value of her exports that the commerce of Germany deserves attention, but rather "the change which has taken place in the nature or character of the trade carried on by Germany." Until recently, that country has been an exporter of raw produce rather than of manufactured goods. Such is no longer the case. The exports from Germany of manufactured goods rose from £42,090,000 in 1875 to £108,178,000 in 1886, or 157 per cent. In 1875 they constituted only 36 per cent. of the exports, in 1886, 75 per cent. The area of the German export trade has correspondingly increased, although German exports to Russia, the United States, France, and Belgium exhibit a decline.

With these exceptions, all the rest of the world appears to have received German produce in larger quantities than heretofore. During the period from 1880 to 1886, German exports to Asia have increased 26 per cent., whilst British have decreased 1 per cent. ; German exports to Africa have increased 28 per cent., while British have decreased 27 per cent. ; German exports to Australasia have increased 346 per cent., whilst British have increased only 32 per cent. ; and German exports to America (the United States excepted) have increased 64 per cent., whilst British have increased only 5 per cent. Britain, with rare exceptions (as in the Argentine Republic, Uruguay, the United States, and India), appears, as compared with Germany, to have lost ground nearly everywhere ; but this is not wholly due to German competition, for Belgians, Americans, and Italians have shown themselves to be quite as keen in the search of new markets as Germans. France, on the other hand, has, like Britain, lost ground in nearly all parts of the world. This ably written article concludes with the warning, so strongly urged lately by Mr. Goschen at Aberdeen, that German competition in every field of commerce will in future have to be reckoned with ; and that however sterling are the capacities and enterprise of the British merchant and manufacturer, they will have to be put forth in their whole strength if British commerce is to hold its ground.

Egypt and Syria : Their Physical Features in relation to Bible History. Second Edition, revised and extended, by Sir J. William Dawson, C.M.G., LL.D., F.R.S. London : The Religious Tract Society. *Price* 3*s*.

There is much valuable information in this small volume, which forms No. vi. of the "By-Paths to Bible Knowledge" series, published by the Religious Tract Society. It contains less straining after arguments to prove that facts agree with Biblical history than is common in books of the description ; but it must be confessed that Sir J. William Dawson has not escaped from occasional efforts of the kind. But faults in this way are few, and are never very obtrusively thrust upon the attention of the reader. A certain vagueness of expression sometimes leaves one in doubt as to the author's exact meaning. For instance, we cannot be quite sure if he accepts the account of the Deluge, as recorded in Genesis, in its entirety ; if he does, it is rather startling to find the statement that the *immediate* posterity of Noah were a mighty, and consequently numerous, people, able to conquer and hold in subjection another less cultivated but wide-spreading nation. Again, we cannot clearly make out if the presence of man on the globe in pleistocene times is entirely denied, or if the author's remarks apply only to Egypt. Having thus pointed out what seem to be faults, it is pleasant to turn to the really valuable parts of the volume. The route suggested as that most probably followed by the Israelites when leaving Egypt, seems to be a very probable line of retreat, and the idea is throughout supported by strong and telling arguments, which are never pushed too far, nor are the inferences drawn from them at all exaggerated. The illustrations are, as a rule, fairly well executed, but if the view of "Skull Hill," on page 109, is at all like the original, the representation of the same spot, on page 108, must be from a very "hasty sketch" indeed. On the whole, it can be said that the author has produced a most readable work, displaying numerous signs of thoughtful preparation and careful execution. To the Biblical student it should be welcome as a useful aid, and in it general and scientific readers will find much to instruct and interest. A good index adds greatly to the value of the book as a work of reference.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE EXPLORATION OF THE GULF OF GUINEA.

By J. Y. Buchanan, F.R.S.

Part I.

In the latter part of the year 1883 the India Rubber, Gutta Percha, and Telegraph Works Company (Limited) of Silvertown, despatched an expedition consisting of two steamers, the *Dacia* and the *International*, to survey the route for a submarine cable to be laid between Cadiz and the Canary Islands. By the kindness of the Company, I was invited to join the expedition, and on board the *Dacia* I was given every facility for utilising, for the benefit of oceanic research, the opportunities afforded by the frequent soundings taken on such an expedition. A summary of the results obtained during this cruise was published in the *Times* of 7th December 1883. The chief feature of the Dacia Expedition was the discovery and investigation of numerous "oceanic shoals," rising abruptly and with precipitous faces out of the deep water lying between the African coast and a line joining Madeira and the Canary Islands.[1]

In 1884 the cable was continued from Teneriffe to St. Louis in Senegambia. In October 1885 an expedition, consisting of the Company's largest steamer, the *Silvertown*, of 5000 tons, and the *Buccaneer*, of 760 tons, left the Thames, to continue the cable down the coast, and connect it with the Cape Verde Islands. When this work was finished, it was intended that the smaller ship, the *Buccaneer*, should proceed down the coast, and survey the route for a further extension of the cable as far as St. Paul de Loanda. In doing this she would pass over entirely unexplored ground, and through waters of the greatest interest from the point of view of oceanic research.

[1] *Proc. R.S.E.* 1885-86, p. 428.

The Gulf of Guinea is the receptacle into which the great counter-equatorial current of the Atlantic, often called the Guinea Current, empties itself, and it is the source whence proceeds the great equatorial current which runs in a westerly direction all the way across the Atlantic, and is probably the most powerful proximate factor in the production of the Gulf Stream. In view of the interest which was known to attach to the scientific exploration of these waters, I was invited to accompany the expedition. Considering the importance of combining biological with physical research, I obtained permission for a trained naturalist to accompany me, and I was fortunate enough to secure the services of Mr. John Rattray, F.R.S.E., who was at the time engaged on original research at the Scottish Marine Station at Granton, and was about to join the staff of naturalists employed on the work of the Challenger Commission. With the leave of Mr. John Murray, Director of the Challenger Commission, Mr. Rattray joined the expedition.

The *Silvertown* sailed from the Thames on the 8th October, and was followed a few days later by the *Buccaneer*. It was expected that all the cable would be laid by the middle of December, and that the *Buccaneer* would be able to start southwards about the 20th December. Accordingly, with Mr. Rattray, I left Liverpool by mail steamer on 5th December, arrived at Sierra Leone on the 19th, and we were met there by the *Buccaneer* on the 21st. Some "cable work," however, still remained to be done, and the *Buccaneer* removed to Dakar, an important French naval station close to Cape Verde. Here the *Silvertown* was met, and the two ships parted company on the 26th December. Captain A. S. Thomson, R.N.R., voluntarily transferred himself from the *Silvertown*, homeward bound, to the *Buccaneer*, which was about to start on a further period of service on the coast, and to this spontaneous act of self-denial on his part is due, in a very large measure, the success which attended the expedition. He was not only unwearied in doing everything to promote the objects of the expedition, but, besides taking entire charge of the navigation of the ship, he also superintended the meteorological work, and any observations of oceanic currents which were obtained, depend for their trustworthiness on his energetic co-operation and initiation. Besides Captain Thomson, Mr. Darling, the Company's analytical chemist, and Mr. Stallibrass, of the telegraph engineer staff, joined the *Buccaneer* from the *Silvertown*. Mr. Darling took exclusive charge of the specific gravity work, and Mr. Stallibrass of the logs and records, while both gentlemen assisted otherwise in all the work that was going on. The officers of the ship also gave much valuable assistance outside of their routine work, and to the harmonious working of all departments on board is due the accomplishment of a very important piece of oceanographical work in a very short time, and with means exclusively furnished by a commercial but public-spirited company.

At 1 A.M. on 29th December 1885, the *Buccaneer* left Dakar, and proceeded southwards. At noon the first sounding was taken, principally with the object of getting men and instruments into their places. The depth found was 2322 fathoms. The weather was in every way perfect, both for personal comfort and for the practical purpose of sounding.

The sea being calm and without a ripple, and there being no current, the whole length of wire ran out and was brought in again without any deviation from the vertical, the ship being motionless the whole time. The result of the first sounding was to show that some alterations would have to be made in the arrangement of the wire sounding-machine in order to make it more suitable for attaching and detaching instruments, such as thermometers, water-bottles, and the like. Since Sir William Thomson revived the use of wire for sounding, by giving the mechanical appliances for using it a practical shape, various modifications have been made on his original design to suit the requirements of those using it. The form fitted on board the Silvertown Company's cable-ships possesses the principal characteristics of the original apparatus, modified for the use of steam in heaving up. It is fixed right aft, so that the sounding is taken over the stern. The drum on which the wire is wound is run out like a gun on its carriage, until it overhangs the water, and then the wire, with the weight attached, is allowed to run directly off the reel. When bottom has been reached, the wire is held by means of a "stopper," while the drum is run back again inboard. The wire between the drum and the stopper is then taken round the driving-pulley of the small rotary engine, which is connected with the drum by a belt. When all is ready the "stopper" is cast off, and the engine started; the weight of the wire coming in is taken by the driving-pulley, and the drum driven by a belt from it takes in the slack wire. This arrangement has two very great disadvantages. In order to work the drum back and forward it has to be about breast-high above the deck, which brings the free hanging wire, when it is run out, so low as to make it difficult to attach instruments without lying down on the deck. This is inconvenient for the man employed, and dangerous for the instruments. An almost greater objection lies in the moving about of the different parts of the machine, the necessity for the use of a stopper, which is always risky for the wire, and especially the fingering of the wire required to take it round the driving-pulley every time it is to be wound in, and to throw it off every time it is to be run out. These difficulties were to a great extent obviated by the drum being fixed in a position as far inboard as it could be brought, by the wire being taken one turn round the driving-pulley once for all, and then being delivered over the stern over a pulley about 8 feet above the deck. The driving-pulley was made to disconnect from the engine. With these alterations, which were all carried out with great skill and promptitude by the engineer staff, under the direction of the chief engineer, Mr. Hoy, the wire never required to be touched. When a sounding was to be taken, the weight, attached to the wire by a few fathoms of line, was lowered into the water, and thermometers could be conveniently attached to the tightened wire. When bottom was reached nothing was required but to connect the engine and heave up, and when all was up, the thermometers were detached, the samples of mud and bottom water received, and everything was ready for another sounding.

Besides these alterations, a very important addition was made to the machine in the shape of a dynamometer. In all deep-soundings the

sample-tube, which usually passes through the centre of the cylindrical or spherical sinker, is fitted with a detaching apparatus so that the sinker slips off, either when the ground takes the weight of the tube or when its weight is being taken by the wire on heaving in. When a good sample of the mud is wanted it is important that the weight of the sinker should be utilised as far as possible for the purpose of shoving the sample-tube into the ground. It is then of great importance to know that the sinker is detached and that the tube has been drawn out of the ground before finally heaving in. For this purpose a Salter's circular spring-balance, registering up to 200 lbs., was used. The wire was led from the driving-pulley over a block attached to the spring-balance, and then over another one to the delivering-pulley over the stern. The angle at which the wire was led over the dynamometer was such that 3 lbs. on the spring-balance indicated a strain of 2 lbs. on the wire. An example will show the use and the value of this addition.

A sounding was taken on the 22d February. When 2650 fathoms had run out, the break was applied, the wire stopped, and the strain exercised by the sinker and wire hanging freely, observed; it was 110 lbs. on the balance. The wire was then allowed to run again, and bottom was struck in 2937 fathoms; the strain then indicated on the balance was 60 lbs. The ship was now allowed to drift, and the strain went up to 110 lbs., and then was suddenly relieved, going back to 40 lbs., indicating by a clear telegraphic signal from the bottom that the weight was slipped and "all clear," and in obedience to it the wire was hove in at once and without risk. The importance of a dynamometer when dealing with heavy strains on a single wire is apparent if it is remembered that the breaking strain of the wire is 225 lbs., that the strain of heaving the sample-tube out of the ground and slipping the weight is 60 to 70 lbs., and that the running strain when heaving in from a depth of 2000 fathoms, at the rate of 50 fathoms per minute, is 100 to 120 lbs. The ordinary working strain of the wire is therefore one half of its breaking strain. Many interesting observations on the strains of wire in sounding were made during the cruise.

After this sounding a course was shaped for Conakry, the French settlement in the Isles de Los, about 70 miles north of Sierra Leone. Here the cable of the West African Telegraph Company terminated, and, having communicated with England, the ship sailed on the afternoon of the 31st December, on her sounding voyage along the coast of the Gulf of Guinea.

The first part of the voyage had for its object the survey of a suitable cable route along the coast as far as St. Paul de Loanda, the chief Portuguese settlement and best harbour on what is called the "South Coast."

This was essentially "cable work," and it was pushed on with all expedition, the soundings being taken night and day. During the taking of these soundings, which necessitated frequent and often prolonged stoppages, it was possible, with the material and hands available on board, to make many valuable observations and collections without causing any extra detention of the ship.

From Loanda it was intended to return home *viâ* Ascension, St. Paul's Rocks, and the Azores, thus following very nearly the route which would be taken by a sailing-ship under the same circumstances. On this part of the voyage it was intended to take soundings, and make other observations at such intervals as were admissible, consistently with the time at disposal. This latter part of the work had to be curtailed owing to want of time. Nevertheless the material and the data collected during the five weeks which comprised the active part of the cruise, are very rich and extensive, and even in the crude state they bring out many facts of great interest regarding the natural conditions of the Gulf of Guinea, where for the first time scientific ground was broken by the *Buccaneer*.

The soundings began on 1st January off Sierra Leone, and, for cable purposes, ended on 9th February off Loanda. During this time—forty days—the ship steamed 4750 miles, the direct distance being 2620 miles, and 363 soundings were taken, being at the rate of over rather nine per day. The average depth of the soundings was 862 fathoms, and the maximum was 2623. An aggregate of 312,882 fathoms of wire were run out in making these soundings, and it was all got back with the exception of 3440 fathoms, the loss being thus 1·1 per cent. On the whole, during this, the first part of the cruise, the work was carried out rapidly and with remarkably little loss of material. After leaving Loanda the conditions seemed to change, and the loss of wire and instruments was very heavy.

There is no doubt that the wire is sufficient for all purposes if it is never handled by any but uniformly careful hands; but the least carelessness or inattention, which would have no effect on a hemp line, causes the loss of a wire and all that it carries. On the other hand, hemp line, to be of any use for really deep work, must be of the very finest description, and must also be carefully looked after. Ordinary sounding line is almost more treacherous than wire, and should not be trusted. The sounding line supplied to the *Challenger* was of an exceptional character. The breaking strain was 14 cwts., and it often brought the sinker, weighing 3 cwts., up from depths of 2000 to 3000 fathoms. It is the only really trustworthy line for thermometer work. The advantage of the wire is that it is more expeditious, and that it offers less surface to currents, and consequently makes work where currents exist easier. It is also more compact, and requires less power to work it. To secure these advantages is worth running some risk, which is reduced exactly in proportion to the care taken of the wire.

In Table I. of the Appendix all the soundings made during the cruise of the *Buccaneer* are collected and arranged in consecutive order, along with the temperature observations which were made at the time, and the densities (at 60° Fahr.) of the samples of bottom water which were collected. Tables II. to V. give all the serial temperature observations that were made at the various stations, arranged in four sections. The route is conveniently divided into these sections—the first comprising the coasting voyage from Conakry to Appi; the second, the voyage across the head of the Gulf of Guinea, from Appi to St. Paul de Loanda; the third, along the parallel of Lat. 6° S., from the Congo to the Island of

Ascension ; and the fourth, from Ascension northwards, roughly along the meridian of 14° W. to Conakry. Figure I. is a sketch chart showing the route of the *Buccaneer*, with the stations.

On her outward voyage in 1873, the *Challenger*, after leaving the Cape Verde Islands, passed within a moderate distance of the African coast down to the mouth of the Gulf of Guinea before she turned westwards

TABLE I.—Comparison of Temperatures observed by the

Ship.	Bu.	Ch.		Bu.	Ch.		Bu.	Ch.		
Station No.	3	100		7	101		48	348	102	
Date.	2 1 86	16 8 73	Difference.	5/1/86	19 8 73	Difference.	13 3 86	9 4 76	21/8 73	Difference.
Latitude.	7° 1′ N.	7° 1′ N.		5° 48′ N.	5° 48′ N.		3° 3′ N.	3° 10′ N.	3° 8′ N.	
Longitude.	15° 54′ W.	15° 55′ W		14° 20′ W.	14° 20′ W.		15° 1′ W.	14° 51′ W.	14° 49′ W.	
Depth.	2584	2425		2596	2560		2611	..	2450	
Depths Fathoms.	Temperature Fahrenheit of									
d	*b*	*c*	*b* − *c*	*b*	*c*	*b* − *c*	*b*	c_1	c_2	$b - c_1$
Surface	82·9	70·0	+3·9	85·5	79·2	+6·3	83·1	84·0	78·0	−0·9
10	...	79·0	...	82·48	...	...	83·0	84·0	78·5	−1·0
20	...	78·0	...	79·6	...	...	81·2	82·2	75·0	−1·0
25	68·9	(75·7)	−6·8	69·0	72·6	−3·6	74·8	...	...	...
30	...	73·4	...	(65·9)	...	...	66·0	70·8	73·4	−4·8
40	...	64·2	...	60·82	...	...	61·2	62·0	70·5	−0·8
50	59·2	60·8	−1·6	58·8	62·5	−3·7	60·0	59·4	68·0	+0·6
75	...	56·8	...	...	59·0	...	58·0	(57·3)	61·0	...
100	56·4	55·2	+1·2	56·07	56·2	−0·13	56·5	56·5	57·0	+0·5
150	...	...	...	...	52·2	...	54·2	54·2	54·8	0·0
200	50·0	49·5	0·5	49·0	47·9	+1·1	47·7	50·7	46·8	+3·0
300	44·2	43·2	1·0	44·0	43·3	+0·7	42·41	43·8	41·8	+1·39
400	...	42·0	...	41·08	40·9	+0·18	40·98	41·2	40·8	+0·22
500	40·9	40·5	0·4	40·32	39·5	+0·82	...	40·0	...	...
600	...	39·6	...	39·77	39·4	+0·37	39·75	40·0	40·0	+0·25
700	...	39·6	...	39·02	...	...	...	40·0	39·0	...
800	...	39·5	...	38·58	39·5	−1·08	39·35	39·7	38·5	+0·35
900	...	38·6	...	...	...	...	...	39·0	...	...
1000	38·1	...	...	38·26	...	...	38·35	39·0	...	...
1250	37·9	(37·7)	+0·2	...	...	...	37·76	(38·4)	37·2	+0·64
1500	36·98	...	...	36·98	...	...	...	37·2	36·9	...
2000	...	...	...	36·51	...	...	...	...	...	...
2111	...	...	...	...	...	...	36·48	...	...	...
2250	...	...	...	...	...	...	...	...	...	...
2450	...	...	...	...	...	...	...	...	36·5	...
2500	...	...	...	...	36·4	...	...	...	...	...
2584	36·06	...	...	...	...	...	...	...	...	...
2611	...	...	..	...	...	...	36·29	...	...	...

towards the Brazils, and made several observations close to where the voyage of the *Buccaneer* began. Again, on her return route in 1876, she made some stations in positions which would be passed by the *Buccaneer* both going out and coming home. Considerable interest attached to repeating the *Challenger* observations, especially those of the temperature of the sea.

Buccaneer and by the *Challenger* in the same Positions.

Difference.	Difference.	Bu.	Ch.	Difference.	Bu.	Ch.	Difference.	Bu.	Ch.
		45	347		43	346		2	99
		10/3/86	7/4/76		7/3/86	6/4/76		1/1/86	15/8/73
		0° 7′ S.	0° 15′ S.		2° 42′ S.	2° 42′ S.		7° 54′ N.	7° 55′ N.
		14° 28′ W.	14° 25′ W.		14° 43′ W.	14° 41′ W.		17° 25′ W.	17° 26′ W.
		2397	2250		2484	2350		2623	..

Water at Depth *d*.

$b-c_2$	c_1-c_2	b	c	$b-c$	b	c	$b-c$			
+5·1	+6·0	81·6	82·0	−0·4	81·5	82·7	−1·2	82·2	78·0	+4·2
4·5	5·5	79·8	81·2	−1·4	81·2	81·6	−0·4	...	...	...
6·2	7·2	78·4	78·0	+0·4	81·0	73/78	+6·0	...	...	...
...	...	...	...	...	65·2	71·6	−6·4	...	...	...
−7·4	−2·6	63·3	74·0	−10·7	61·8	59·1	+2·7	...	...	...
−9·3	−8·5	...	69·8	...	...	57·4	...	...	...	...
−8·0	−8·6	59·2	65·2	−6·0	57·3	57·1	0·2	56·85	63·2	−6·35
−3·0	−3·7	56·7	(59·6)	−2·9	56·2	(55·8)	0·4	...	...	...
−0·5	−1·0	55·8	57·5	−1·7	55·8	55·0	0·8	56·18	56·2	−0·02
−0·6	−0·6	50·9	53·6	−2·7	52·7	52·2	0·5	...	...	..
+0·9	+3·9	47·2	48·0	−0·8	49·2	48·8	0·4	48·82	49·8	−0·98
0·61	2·0	...	..	...	42·63	43·2	−0·57	45·05	45·8	−0·73
0·18	0·4	...	...	...	40·95	40·6	+0·35	41·54	42·2	-0 66
...	...	...	...	...	..	39·2	...	40·24	41·4	−1·06
−0·25	0·0	...	...	...	39·41	39·3	0·11	...	...	...
...	+1·0	...	...	...	...	...	...	...	...	...
+0·85	1·2	...	...	...	39·30	39·1	0·20	...	...	...
...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	39·0	...	...	...	...
...	1·2	...	...	...	...	...	...	...	...	...
...	0·3	...	...	...	...	37·5	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...
...	...	...	36·2	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...
...	...	35·62	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...

TABLE I*a*.—Comparison of Densities observed by the

Ship.	Bc.	Ch.	Difference.	Bc.	Ch.	Difference.	Bc.	Ch.		Difference.
Station No.	3	100		7	101		48	348	102	
Date.	2/1/86	16/8/73		5/1/86	19/8/73		13/3/86	9/4/76	21/8/73	
Latitude.	7° 1′ N.	7° 1′ N.		5° 48′ N.	5° 48′ N.		3° 3′ N.	3° 10′ N.	3° 8′ N.	
Longitude.	15° 54′ W.	15° 55′ W.		14° 20′ W.	14° 20′ W.		15° 1′·5 W.	14° 51′ W.	14° 49′ W.	
Depth.	2584	2425		2596	2500		2611	..	2450	
Depths Fathoms.	Density at 60° Fahr. of The figures 1·02 are omitted for the sake of									
d	*b*	*c*	*b* − *c*	*b*	*c*	*b* − *c*	*b*	*c*	c_2	$b - c_1$
Surface	567	612	−45	543	635	−92	561	578	589	−17
10	...	...	...	...	...	...	566	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	596	...	...	...
25	626	...	...	629	...	...	630	599	...	31
30	...	...	...	...	...	...	630	...	...	...
40	...	652	...	...	...	...	634	...	...	...
50	619	...	...	627	...	...	628	629	661	−1
75	...	...	...	...	...	...	613	...	...	...
100	608	626	−18	612	...	...	603	627	645	−24
150	...	...	...	...	...	...	600	...	...	...
200	581	597	-16	599	...	...	575	589	619	−14
300	593	...	...	584	...	...	...	602	609	...
400	...	...	...	...	...	...	...	580	633	...
500	586	...	...	...	...	...	...	...	...	...

In Table I., all the observations of temperature and of density which were made by the *Buccaneer* and the *Challenger* at the same localities have been collected. The *Buccaneer's* stations numbered 2, 3, and 7, made on the 1st, 2d, and 5th of January 1886 respectively, are compared with Nos. 99, 100, and 101 of the *Challenger* made on the 15th, 16th, and 19th of August 1873 respectively. Station No. 45 of the *Buccaneer*, made on the 10th March 1886, is compared with No. 347 of the *Challenger*, made on the 7th April 1876; and No. 48 of the *Buccaneer*, made on the 13th March 1886, is compared with Nos. 102 and 348 of the *Challenger*, made on the 21st August 1873 and the 9th April 1876 respectively. It will be seen that the *Buccaneer's* observations in March do not differ much from those of the *Challenger* in April. At station No. 45 of the *Buccaneer* the temperature of the water from the surface to a depth of 200 fathoms is decidedly lower than at the *Challenger* station No. 347 in April; at 30 fathoms it is 10°, and at 50 fathoms 6° lower. Comparing the *Buccaneer's* station No. 43 in March with the *Challenger's* station No. 346 in April, the temperature down to 25 fathoms is higher in April than in March,

Buccaneer and by the *Challenger* in the same Positions.

Difference.	Difference.	Bu.	Ch.	Difference.	Bu.	Ch.	Difference.	Bu.	Ch.
		45	347		43	346		2	99
		10.3.86	7.4.76		7/3/86	6.4.76		1.1.86	15.8.73
		0° 7′ S.	0° 15′ S.		2 42′ 43′ S.	2° 42′ S.		7° 54′ N.	7° 53′ N.
		14° 28′ W.	14° 25′ W.		14 43′ 53′ W.	14° 41′ W.		17° 25′ W.	17° 26′ W.
		2397	2250		2484	2350		2623	..

Water at Depth *d*.
clearness, being common to all the Observations.

$b-c_2$	c_1-c_2	b	c	$b-c$	b	c	$b-c$			
−28	−11	625	639	−14	610	624	−14	210	...	...
...	...	631	...	...	627	...	...	...	...	...
...	...	...	...	...	603	...	...	...	...	...
...	...	652	...	...	610	...	...	...	...	...
...	...	(660)	664	− 4	624	633	− 9	620	...	...
...	...	665	...	...	621	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...
−33	−32	672	690	−18	603	614	−11	620	...	...
...	...	627	...	...	603	...	...	...	...	...
−42	−18	649	609	+40	621	618	+ 3	609	...	...
...	...	646	...	...	587	...	...	...	...	...
−44	−30	676	...	...	616	602	+14	589	...	...
...	− 7	...	565	...	...	570	...	575	...	...
...	−53	...	...	...	...	556	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...

except at 20 fathoms, where the great fall of temperature had begun in April, but had not done so in March. It must, however, be borne in mind that at these critical depths, where the temperature is falling at the rate of perhaps 2° to 3° Fahr. per fathom, a very slight error in the depth makes a very great error in the temperature.

When the *Buccaneer's* observations in January or March are compared with those of the *Challenger* in August, a very marked difference in the distribution of temperatures is observed. In all cases the temperature of the surface is from 4° to 6° warmer in March or January than in August. At 25 fathoms the temperature is very much higher in August than in January or March, and at 100 to 150 fathoms the conditions are again reversed, and the water in the early part of the year is again warmer than in August. The conditions at station No. 2 of the *Buccaneer* and No. 99 of the *Challenger* seem to form an exception.

If the densities observed in the *Buccaneer* be compared with those made in the *Challenger*, it will be seen that the density of the surface water and of the layer of water down to 50 fathoms is much higher in

August than in January or March, and there is also much less difference between the density of the water at the surface and that of the water in the layers immediately below, which makes it easier for the surface temperature to be transmitted downwards in August than in January. There is reason to believe that over the whole area affected by the Guinea current there are great seasonal variations of density and of temperature accompanying variations in the characters of the current.

In temperate latitudes the temperature of the sea follows more or less closely the changing temperature of the air. In the deeper lakes of Great Britain, for instance, the greatest amount of heat is found in their waters about the autumnal equinox, and the least amount about the vernal equinox. Heat is accumulated so long as the length of the day is greater than that of the night, and it is lost during the time that the opposite is the case. In tropical and equatorial regions the length of the day from one season of the year to another, and the temperature of one season compared with another, vary so little, that great differences were not to be suspected. In comparing the *Challenger's* and the *Buccaneer's* observations, the variation in the temperature of the surface is, as might have been expected, small, while at depths of 25 or 50 fathoms there are great variations. *Challenger* stations Nos. 99, 100, and 101 were made in the middle of August 1873, and they were repeated by the *Buccaneer* in the first week of January 1886. In August 1873 the surface temperature varied from 78° to 79°, while in January 1886 it varied from 82° to 85°. At a depth of 50 fathoms below the surface the temperature of the water ranged in August 1873 from 61° to 63° Fahr., and in January 1886 from 56° to 59° Fahr., the fall of temperature between the surface and 50 fathoms, being on an average 16° in August and 25° in January. The "Temperature Gradient" is much steeper in January than it is in August. Were we dealing with water of temperate latitudes, where the low temperature of the water at 50 fathoms could be attributed to cooling during winter, we should say that the distribution of temperature in January had a vernal character, and in August an autumnal one. It is in this region that the most rapid falls of temperature within a few fathoms are witnessed. At every station made by the *Buccaneer* in the Gulf of Guinea and neighbouring equatorial waters, there was a stratum lying usually between 15 and 30 fathoms below the surface where the temperature fell at the rate of from 1°·5 to 2° Fahr. per fathom of depth. On one occasion a fall of 15° was registered between the temperatures at 15 fathoms and at 20 fathoms. *Challenger* station No. 350 was made on the 11th April 1876, and was repeated by the *Buccaneer* on 3d January 1886. The surface temperature was 85° in April and 84° in January, but at depths between the surface and 100 fathoms the temperature was from 2° to 5° colder in January than in April. At the point where the *Challenger* turned westwards in 3° N. lat. in 1873, she made a station on the 21st August. On the 11th April 1876 she made a station again in this position, on her way home; and on 13th March 1886 the *Buccaneer* made her last station on her voyage home on the same spot. In March the surface temperature was 83°, and in April 84°. Down to a depth of 50 fathoms, approxi-

mately the same difference of temperature is maintained. From 50 fathoms to 100 fathoms the water in March is slightly warmer than in April. The character of the temperature distribution is essentially the same in March as in April, only in April the gradient is slightly steeper. In August, on the other hand, the distribution assumes quite another character; it is strongly autumnal as compared with that of March or April. The surface temperature is only 78°, but at 25 fathoms it is 75° Fahr., the same as in March. Below 25 fathoms the water is much warmer in August than in March, but at 100 fathoms the temperatures are almost identical. The mean temperature of the whole stratum from the surface to a depth of 100 fathoms is thus really higher in August than in March, though the temperature of the surface is 6° lower in the former than in the latter month.

The repetition of temperature observation, such as the *Challenger's* at different seasons of the year, and at the same season in different years, is the only means of procuring data for the solution of many oceanographical problems of the highest importance, and as a field for research it is at present practically untouched. In comparing the temperatures of the *Challenger* and the *Buccaneer* some allowance has to be made for the difference in the thermometers used. The instrument supplied to the *Challenger*, and known as the Casella-Millar deep-sea thermometer, was too small, and had no scale engraved on the stem of the instrument itself. It was impossible, with it, to be sure of temperatures within half a degree.

The *Buccaneer* was supplied with an improved form of the same instrument, made by Mr. Casella according to my design, supplied after the return of the *Challenger*. It has two scales, one an arbitrary one, etched on the glass stem of the instrument, and the other of Fahrenheit's degrees, on a glass slip at the side. The arbitrary scale is relied on for accuracy, but both are read, the double reading affording an insurance against errors. Temperatures taken by this instrument can be relied on to one-tenth of a degree Fahrenheit.

The great delicacy of this instrument made it peculiarly suitable for investigating the temperature of the deeper strata of the ocean, and it was largely used for this purpose. Much interesting information was obtained which would have been entirely masked by using the older form of instrument.

In the case of the deep water of the ocean, differences of one- or two-tenths of a degree in the temperature of the water often indicate very important differences in the topographical and physical conditions of the basin. In order as far as possible to render account of these conditions, I attached as often as possible a thermometer to the end of the sounding-line, and another at a certain height, almost always 250 fathoms above it, while the sounding-tube generally employed in important soundings[1] was so constructed that a large sample of the bottom water, the genuineness of which was guaranteed by the lower part being sealed by a perfect plug of mud, was secured. The information thus obtained with regard

[1] This apparatus is described in the *Challenger Reports, Narrative*, i. p. 117.

to the temperature and density of the water at the bottom of the Gulf of Guinea is such as, up to the present time, we possess for no other part of the ocean. The temperatures and densities so observed are included in Table I. of Appendix, in which all the deep-sea soundings, 411 in number, are entered, with their position and number. Next to the "number of soundings," the letter designating the profile is given, as in an earlier paper in this journal.[1] The column headed (t − T) gives the rate of fall of temperature for 250 fathoms increase of depth.

TABLE II.—Temperature of Bottom Water at every hundredth fathom, from 500 fathoms to 2000 fathoms, deduced from observations made during Profile Sounding.

Date, Jany. 1886,		3d.		4th.		6th.		10th.		11th.		13th.		18th.		19th.	
Sounding Nos.		7—14.		23—27.		31—42.		80—83.		90—97.		128—131.		181—184.		188—189.	
Profile, . .		A		B		C		F		G		K		S		S′	
Depth.	Mean Temp.	Temperature (Fahr.) at Depth d.															
d	T	a	da	b	db	c	dc	f	df	g	dg	k	dk	s	ds	s'	ds'
500	°	°															
600	39·78	..	..	40·20	·42	..	..	..	..	39·68	−·10	..	..	39·37	−·41		
700	·52	39·70	·18	39·84	·32	39·49	−·03	39·60	·08	·33	−·19	..	..	·17	−·35		
800	·04	·12	·08	·20	·16	38·91	−·13	·10	·06	·00	−·04	..	..	38·92	−·12		
900	38·64	38·59	−·05	38·67	·03	·52	−·12	38·68	·04	38·70	·06	..	..	·69	·05		
1000	·36	·29	−·07	·51	·15	·21	−·15	·30	·06	·40	·04	..	..	·42	·06		
1100	·16	·06	−·10	·40	·24	·00	−·16	..	..	·13	−·03	38·21	·05	·18	·02		
1200	37·84	37·82	−·02	..	..	37·80	−·04	..	..	37·80	−·04	37·93	·09				
1300	·58	·61	·03	..	..	·60	·02	..	..	·41	−·17	·70	·12				
1400	·32	·41	·09	..	..	·41	·09	..	..	·25	−·07	..	..	..	..	37·20	−·12
1500	·09	·22	·13	..	..	·21	·12	36·95	..	·12	·03	..	..	..	..	36·97	−·12
1600	36·88	·04	·16	..	..	36·75	−·13	·80	−·08	36·91	·03						
1700	·75	36·90	·15	..	..	·65	−·10	·70	−·05	·74	−·01						
1800	·60	·72	·12	..	..	·55	−·05	·60	·00	·56	−·04	36·57	−·03				
1900	·51	·52	·01	..	..	..	..	·55	·04	..	..	·47	−·04				
2000	·50	·51	..	..	..	..	..	·50									

In Table II. the temperature of the bottom water at every hundredth fathom from 500 to 2000 fathoms, as deduced from temperatures observed in profile soundings on the section Conakry to Appi between the 1st and 19th January 1886, is given. The bottom temperatures on each profile were plotted, and curves drawn through them, the temperatures entered on those corresponding to the intersections of the curve with the depth lines of each hundredth fathom. The means of all the temperatures at each depth have been calculated, and entered in column T. The differences *da*, *db*, etc. are the quantities to be added to the means to give the temperature in the particular profile, thus $db = b - T$. Table III. is constructed in exactly the same way for the temperatures, at 250 fathoms from the bottom. Considering the bottom temperatures we see that, westward of Cape Palmas, in profile C. the temperature is below the mean between 600 and 1200 fathoms, and again between 1500 and 1800 fathoms; on profile A. the temperature is above the mean between 600 and 800 fathoms, below it between 800 and 1200 fathoms, and above it at greater depths. On profile B. the temperature is above the mean

[1] *Scottish Geographical Magazine*, May 1887.

at all depths between 500 and 1100 fathoms. Eastward of Cape Palmas the temperature between 500 and 800 fathoms is below the mean both at profile G. and S., but at F. it is above the mean down to 1000 fathoms. At G. it is below the mean from 1000 to 1400 fathoms; at S. it is below

TABLE III.—Temperature of Water at 250 fathoms from the Bottom, at every hundredth fathom between 500 and 1600 fathoms, from Profile Sounding.

Date, Jany. 1886, / Sounding Nos. / Profile, . . .		6th. 31—42. C		11th. 90—97. G		13th. 128—131. K		18th. 181—184. S		19th. 188—189. S′	
Depth.	Mean Temp.	Temperature (Fahr.) at Depth d.									
d	T		dc	g	dg	k	dk	s	ds	s'	ds'
	°	°	°					°			
500	..	..	..	..	..	..	..	39·92			
600	39·74	39·85	+·11	..	..	..	..	·62	−·12		
700	39·39	·55	·16	39·30	−·09	..	..	·33	−·06		
800	39·11	·30	·19	38·89	−·22	..	..	·14	−·03		
900	38·62	38·75	·13	·51	−·11	38·60	−·02				
1000	38·36	·33	−·03	·27	−·09	·47	+·11				
1100	38·06	·02	−·04	·07	+·01	·10	·04				
1200	37·90	37·89	−·01	37·98	·08	37·83	−·07				
1300	37·62	·65	+·03	·70	−·08	·58	−·04				
1400	37·28	·30	·02	·17	−·11	·30	·02	..	..	37·36	+·08
1500	37·09	·10	·01	·03	−·06	·03	−·06	..	..	·20	·11
1600	..	..	..	..	..	36·81					

the mean between 1300 and 1500 fathoms. Considering the water at 250 fathoms from the bottom, we see at profile C. that the conditions of the bottom are reversed; from 500 to 900 fathoms the temperature is above the mean, and again from 1200 to 1500 fathoms. The same holds

TABLE IV.—Comparison of Temperature of Water at the same depth when in contact with the Bottom, and when 250 fathoms above it.

Depth, Fathoms.	Temperature (Fahr.) at Depth d.														
	Profile C.			Profile G.			Profile K.			Profile S.			Profile S′.		
	250 fathoms from Bottom.	Bottom.	Difference.	250 fathoms from Bottom.	Bottom.	Difference.	250 fathoms from Bottom.	Bottom.	Difference.	250 fathoms from Bottom.	Bottom.	Difference.	250 fathoms from Bottom.	Bottom.	Difference.
d	c	c_1	$c-c_1$	g	g_1	$g-g_1$	k	k_1	$k-k_1$	s	s'	$s-s_1$	s'	s'_1	$s'-s'_1$
	°	°	°	..	..	°	′	°	°	°	°	°	′	′	°
500	..	..	..	..	..	..	..	..	..	39·92					
600	39·85	..	..	..	39·68	..	..	..	..	·62	39·37	·25			
700	·55	39·49	·06	39·30	·33	−·03	..	..	..	·33	·17	·16			
800	·30	38·91	·39	38·89	·00	−·11	..	..	..	·14	38·92	·22			
900	38·75	·52	·23	·51	38·70	−·19	38·60								
1000	·33	·21	·12	·27	·40	−·13	·47								
1100	·02	·00	·02	·07	·13	−·06	·10	38·21	−·11						
1200	37·89	37·80	·09	37·98	37·80	+·18	37·83	37·93	−·10						
1300	·65	·60	·05	·70	·41	·29	·58	·70	−·12						
1400	·30	·41	−·11	·17	·25	−·08	·30	..	..	..	..	..	37·36	37·20	·16
1500	·10	·21	−·11	·03	·12	−·09	·03	..	..	..	..	..	·20	36·97	·23
1600	..	36·75	..	..	36·91	..	36·81								

at S. between 1300 and 1500 fathoms. In Table IV. the results of Tables II. and III. are combined, and we see that on profile C. water of the same depth is colder when in contact with the bottom than when 250 fathoms above it down to a depth of 1300 fathoms. On profile S. the bottom water is the warmer down to 1100 fathoms. In profile C. and G. the bottom water is the warmer at depths of 1300 to 1500 fathoms, while the reverse is the case on profile S.

The serial temperature observations made in the Section Conakry to Appi, are collected in Table II. of the Appendix. Station No. 11 is included in this section as well as in the next one. In the last column will be found the means of the temperatures at each depth, when a sufficient number of observations was made. In the earlier stations, the number of observations in the surface layer is deficient, but after the first day or two, this layer, down to 50 fathoms, was generally tested at intervals of 10 fathoms. In some cases it will be seen that temperatures have been observed at odd number of fathoms, such as 24, 32, 57 ; these are, as a rule, depths corrected for error due to the line not being vertical. The observations, as given, have been plotted, and curves drawn for each station representing the vertical distribution of temperature at that station. From these curves the depths at which every whole number of degrees, down to 40° Fahr., and every fifth of a degree below that temperature, occurs, have been taken out. Figs. 2 and 3 represent graphically the result. In Fig. 2 the water between 50 and 500 fathoms is dealt with in detail, the isothermals for every whole degree being drawn out. The mean surface temperature is 83°·29, and that of the water at 25 fathoms is 67°·29, giving a range of 16°. As the surface layer of water has a temperature over 80° Fahr., which entered to a depth of at least 15 fathoms, and the mean temperature at 20 fathoms is 77°·65, the greater part of this large fall of temperature takes place in the layer between 20 and 25 fathoms, where the mean rate of fall is 2° per fathom. In order to indicate these features, it would be necessary to make a diagram on a very exaggerated scale of depth. The character of the distribution of temperature in the water between the surface and 50 fathoms is shown by the isothermals of 80°, 70°, and 60°, in the Figure. The three inshore sections Fig. 2, *a*, *b*, *c*, are at right angles to the main line of section, which embraces Stations Nos. 2, 3, 7, 9, 10 and 11. These lie on a line roughly parallel to the coast, and at a distance of 60 to 100 miles from it. Station No. 4 lies 45 miles inshore of No. 3. Stations 5 and 6 are 125 and 105 miles respectively inshore of No. 7, and No. 8 is 60 miles inshore of No. 9. These distances are in round numbers.

Fig. 4 represents graphically the data of Table II., and shows the distribution of ten positions in the water when in contact with the bottom at depths between 500 and 2000 fathoms.

In comparing these diagrams, we see that, in the position corresponding to Station No. 3, the temperature of the water at depths greater than 600 fathoms is very much the same, whether the water is at the bottom or at an intermediate depth. Between this and Station No. 7, the isothermals 40°·0 to 38°·4, and again those from 38°·0 to 38°·2 have a smart rise in intermediate water. A similar, but on the whole less

marked, rise is observed in the isothermals at the bottom, so that between the depths of 500 and 1500 fathoms, the intermediate water at Station 7 is decidedly cooler than water of the same depth in contact with the bottom. Fig. 3 *a*, shows that the same holds good for intermediate water as observed at No. 6. Proceeding further along the coast we find off Cape Palmas that the water between 500 and 800 fathoms is still warmer at the bottom than out at sea, but at greater depths it is very distinctly colder when at the bottom than when occupying an intermediate position. On entering the Gulf of Guinea proper, the isothermals occupy very much the same position whether they refer to intermediate or to bottom water. In the vicinity of Station No. 11, the bottom water is as a rule colder than intermediate water of the same depth, while at Station 10 the intermediate water is slightly the colder.

Looking at the two diagrams, and confining our attention to the water between 500 and 2000 fathoms, we see in the intermediate water a rapid fall of temperature between 600 and 900 fathoms, indicated by the greater closeness of the isothermals. Between 900 and 1200 fathoms, the isothermals open out, and the temperature falls at a much diminished rate. Between 1200 and 1700 fathoms the rate again increases, and at depths greater than 2000 fathoms, and westward of Cape Palmas, the temperature falls gradually as the depth increases. Off Cape Palmas and to the eastward of it, and all through the Gulf of Guinea, so far as it was explored, the temperature of the water of these great depths was found to lie between 36°·4 and 36°·5 Fahr. It is probable that the ridge on which the Island of Ascension is situated is connected with the African continent by a spur, with a maximum depth of 1900 or 2000 fathoms on it, and that the basin of the Gulf of Guinea is isolated from the southern Atlantic Ocean by a loftier ridge with shallower water over it. The increased rates at which the temperature falls between 600 and 900, and between 1200 and 1700 fathoms, are found also in the diagram of temperature of the water at the bottom, but the differences are not so marked. The layers of water seem to be more mixed at the bottom than at intermediate depths.

In Table V. (next page) the mean temperatures (T) at each depth, taken from Table II. of Appendix, are given, and the rate is calculated at which the temperature falls, in degrees per 10 fathoms, in the interval between each successive depth. Between the surface and 20 fathoms the temperature falls gradually at less than 3 Fahr. per 10 fathoms. Between 20 and 25 fathoms the principal fall occurs at a rate of 20°·72 in 10 fathoms. The rate then falls off, but another increase in the rate occurs between 150 and 200 fathoms. These two measures in the rate of fall of temperature with increasing depth are very characteristic of this part of the ocean, and both occur in the *Challenger's* temperature observations. It would perhaps be more correct to say that it is the thorough mixture of the water between 80 and 150 fathoms which is characteristic, and not the stratification between 150 and 200 fathoms. These remarkable features in the temperature distribution are accompanied by, and are in some measure due to, equally remarkable features in the distribution of density or salinity in the water. This subject, as well as the discussion of the

TABLE V.—The Rate of Fall of Temperature, in degrees per 10 fathoms, and the Differences between the Mean and the Observed Temperatures in Table II. (Appendix) for Stations No. 2 to 11.

Depth (fms.)	No. of Obs.	Mean Temp. T.	Difference.	Fall of Temperature, degs. per 10 fathoms.	Quantities to be added to the Mean Temperature (T) to give the Observed Temperature at Station No.									
					2	3	4	5	6	7	8	9	10	11
0	10	83·20			−1·0	−0·3	−0·2	0·00	0·20	2·50	−0·40	−0·20	0·50	0·00
10	5	80·41	2·79	2·79										
20	5	77·65	2·76	2·76										
25	8	67·29	10·36	20·72	...	1·61	−4·51	...	0·71	1·71	0·09	0·51	0·51	−0·49
30	3	67·83	−0·54											
40	5	62·82	5·01	5·01										
50	10	60·18	2·64	2·64	−3·23	−0·98	−1·67	1·97	1·82	−1·38	2·12	−0·59	1·27	0·72
60	4	59·32	0·86	0·86										
80	4	58·05	1·27	0·64										
100	9	56·88	1·17	0·59	−0·70	−0·48	−1·37	...	0·68	−0·81	1·12	0·62	1·12	1·20
150	4	54·04	2·84	0·57			0·16					−0·04	1·48	1·36
200	9	48·56	5·48	1·094	0·26	1·44	1·83		0·44	0·44	−1·46	−1·66	−0·73	−0·56
300	9	43·82	4·74	0·474	1·23	0·38	0·36		0·38	0·18	−1·44	−1·17	0·03	−0·79
400	7	41·00	2·82	0·282	0·54	...	...	...	0·29	0·08	0·00	0·15	0·06	−0·80
500	7	40·30	0·70	0·070	0·04	0·60	...	..	0·12	0·02	...	−0·17	−0·10	−0·46
600	5	39·76	0·54	0·054	...	...	...	...	0·31	0·01	...	−0·05	−0·11	−0·15
700	3	39·30	0·46	0·046	...	...	..	...		−0·28	...	0·17	0·10	
800	4	38·98	0·32	0·032	...	...	...	...		−0·40	...	0·26	0·12	0·14
900														
1000	5	38·31	0·67	0·034	...	−0·21	...	...	0·16	−0·05	...	0·07	0·14	0·06
(1500)		36·90	1·41	0·028	...	0·08	...	...	...	0·08	...	...	...	0·10
1524	.5	36·96												

temperatures observed in the other section, is reserved for another paper. It may, however, be indicated generally,—that the surface water on the Guinea Coast has a very low density, varying between 1·0243 and 1·0248 (at 60° Fahr.) at the inshore stations, and from 1·0253 to 1·0257 at the seaward stations, the rise in density being roughly proportional to the distance from the coast.[1] At 25 fathoms the mean density is 1·02614. The occurrence of salter water under the warmer and less salt water excludes convection, and therefore retards the mixture of the water of different layers, and the equalisation of their temperature.[2] On the other hand, the density falls from 1·0263 between 50 and 100 fathoms, to 1·0259 between 100 and 200 fathoms. Here the conditions are reversed, the salter water overlying the fresher, and in consequence, when the water of an upper layer falls to the same temperature as the contiguous water of the layer immediately below it, it sinks owing to its greater salinity, producing convection currents and bringing about the mixing of the waters and the equalisation of their temperatures, as we see in the layer between 60 and 150 fathoms. It must be remembered that the above observations were made in the beginning of the year. There seems to be a complete change in the temperatures, the density, and in the rate and direction of flow of the surface water in the opposite season of the year. In July and August the temperature and density of the water are such as would be produced if the surface layer of January were drained away to a depth of 20 fathoms, bringing the cooler and denser layers of the deeper water to the top.

In the second part of Table V., the quantities are given which have to be added to the mean temperature (T) to give the observed temperatures at the various stations. At 50 fathoms it is remarkable that at all the seaward stations from No. 9, off Cape Palmas westward, the temperature is below the mean; east of Cape Palmas, on the line of section, and west of it at the more inshore stations, the temperature is above the mean. At 100 fathoms the temperature is below the mean west of Cape Mesurado, and above it to the eastward. From 200 to 600 fathoms the opposite is the case.

In Table VI. all the densities of bottom water observed on this section are collected and arranged according to longitude and depth, the first figures 1·02 being left out as common to them all. Thus the first entry is 527 under the longitude column 12° W., and opposite the depth 200; this means that between long. 12° and 13° W. a bottom water was obtained from a depth between 200 and 300 fathoms, the density of which at 60° Fahr. was 1·02527. There are eighty-seven separate determinations of density included in the table, and they show in a remarkable manner the great uniformity of the density of the deep water on this part of the coast. At depths greater than 600 fathoms the mean density of the bottom water at any depth lies between 1·02570 and 1·02580. In this it differs enormously from the bottom water of the north-west coast of Africa as determined in the expedition of 1883.

[1] *Proc. Roy. Geogr. Soc.*, 1886, vol. viii. p. 761.
[2] *Proc. R. S.*, 1875, xxiii. p. 123.

TABLE VI.—Density, at 60° Fahr., of the Bottom Water on the Guinea Coast, arranged according to Depth and Longitude.

			C. St. Anne.			C. Mesurado.		C. Palmas.		C. Three Points.			C. St. Paul.			Appi.	
Long.	17° W.	15°	14°	13°	12°	11°	8°	7°	6°	5°	3°	1°	0° W.	0° E.	1°	2°	3°	4° E.	Mean.
Depth.	Density at 60° F. of Bottom Water, the figures 1·02 being omitted before each entry.																		
200	..	..	..	..	527	..	575	..	572	..	..	..	..	..	..	..	..	..	558
300	..	..	..	..	..	..	..	..	..	..	..	..	..	550	558	..	..	..	554
400	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	561	..	..	561
500	..	..	..	..	..	572	..	..	..	..	..	..	..	551	..	580	..	..	568
600	..	..	..	582	590	..	..	..	575	..	..	..	..	..	564	..	..	..	580
				582	586														
700	..	..	554	..	..	..	575	..	..	..	..	..	..	..	..	571	..	..	567
800	..	..	..	582	590	..	..	..	..	..	..	..	..	575	578	..	..	..	581
900	..	..	573	..	..	..	..	583	..	..	..	..	..	..	569	..	..	..	579
1000	..	..	..	..	567	..	..	..	..	..	579	551	..	..	571	569	..	..	570
															581				
1100	..	..	..	..	..	..	..	..	582	..	..	..	..	..	578	570	..	..	577
1200	..	..	573	..	..	..	..	..	..	..	586	..	..	562	568	570	..	..	572
1300	..	..	584	..	577	..	..	..	575	..	..	..	..	578	578	..	577	..	578
1400	..	..	..	..	577	..	..	..	..	..	..	..	..	563	598	..	562	..	576
														579					
1500	..	..	609?	..	574	..	..	573	..	575	..	..	..	..	..	..	580	..	577
1600	..	..	..	582	565	..	..	..	..	565	..	..	..	..	..	..	..	..	571
1700	..	..	583	..	571	..	..	..	..	..	578	579	..	..	..	..	560	..	574
					575														
1800	..	..	..	..	571	..	..	..	..	582	589	..	..	..	..	..	..	..	581
											582								
1900	..	..	573	..	..	..	..	..	..	..	..	..	569	..	..	..	..	..	577
			589																
2000	..	..	587	..	..	..	..	581	..	..	..	..	..	..	..	..	..	575	578
2100	..	..	591	564	..	..	..	..	..	..	..	..	..	..	..	..	..	..	578
2200	..	..	584	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2300	..	..	..	581	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2400	..	585	..	579	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2500	..	581	574	..	..	..	..	580	..	..	..	..	..	..	..	..	..	..	..
		589																	578
2600	609	576	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2700	..	..	..	577	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

In Table VII. all the temperatures of water from the bottom, and from great depths, also all the densities of trustworthy samples of bottom water observed on board the *Dacia* are given. It will be seen that the density of the deep water in this part of the Atlantic Ocean varies from 1·02630 to 1·02664, and is therefore much higher than is found in any other part of the open ocean. As the brine overflow from the Mediterranean, having a density over 1·0280, is all emptied into this part of the Atlantic, there can be no doubt that the high density of the bottom water is due to the admixture of Mediterranean water.

But the overflow of the Mediterranean has not only a high density, it has also a high temperature (55° F.). Its high density enables it to carry its high temperature into the deeper layers of the lighter ocean water by convection; and accordingly we find 36°·42 F. as the average of six determinations of bottom temperature at depths between 2300 and 2400 fathoms, the actual mean depth being 2339 fathoms. The lowest temperature was 36°·35 and the highest 36°·47. There is some indica-

TABLE VII.—Temperature and Density, at 60° Fahr. of Bottom Water in the North Atlantic off the Morocco Coast. S.S. *Dacia*, 1883.

Date. 1883.	No. of Sounding.	Position. Lat. N.	Position. Long. W.	Depth Fathoms.	Temp. Fahr.	Density at 60° Fahr.	Remarks.
13 Oct.	116	32 32	11 0	2340	36·41	...	
13 ,,	117	33 12·5	10 47·5	2319	36·35	...	
13 ,,	,,	,,	,,	1300	39·0	...	Intermediate.
13 ,,	,,	,,	,,	1800	36·93	...	,,
13 ,,	119	32 59	10 39	2285	36·35	...	
13 ,,	120	32 36·5	10·26	1764	36·47	...	
14 ,,	121	32 28	10 21·5	1790	36·59	...	
14 ,,	122	32 22	10 17·5	1510	36·65	...	
14 ,,	125	32 14	10 4	892	42·89	...	
15 ,,	144	32 9	10 51·5	1763	36·59	...	
15 ,,	146	32 40·5	12 8	1940	36·41	...	
16 ,,	148	33 17·5	13 35	2325	36·41	...	
16 ,,	149	33 23	13 47·5	2350	36·41	...	
16 ,,	,,	,,	,,	1800	36·88	...	Intermediate.
16 ,,	,,	,,	,,	1300	38·7	...	,,
16 ,,	151	33 29	14 0	2375	36·47	...	
16 ,,	,,	,,	,,	1860	36·95	...	Intermediate.
16 ,,	152	33 33	14 13	2325	36·47	...	
16 ,,	,,	,,	,,	1825	37·0	...	Intermediate.
18 ,,	190	33 55·5	14 35·5	1680	37·13	...	,,
18 ,,	,,	,,	,,	2190	36·47	1·02649	Bottom.
18 ,,	,,	,,	,,	970	41·67	...	Intermediate.
18 ,,	194	33 41	14 31	1735	36·88	...	
18 ,,	,,	,,	,,	1200	38·31	...	Intermediate.
19 ,,	197	32 3·5	13 57·5	2205	36·17 ?	...	
19 ,,	,,	,,	,,	1700	36·69	...	Intermediate.
19 ,,	,,	,,	,,	1000	40·7	...	,,
19 ,,	,,	,,	,,	500	49·42	...	,,
19 ,,	202	31 41·5	13 49	1961	36·52	1·02630	
19 ,,	,,	,,	,,	1430	37·32	...	Intermediate.
19 ,,	203	31 4	13 32	1189	38·85	...	
19 ,,	204	31 0·5	12 31	1386	...	1·02630	
20 ,,	226	31 11	13 48	844	...	1·02638	
22 ,,	266	30 47	14 22·5	1670	...	1·02656	
24 ,,	283	28 28	15 29·5	1875	...	1·02643	
27 ,,	285	28 16	15 6	1480	38·0	1·02657	
27 ,,	286	28 25	14 46	1479	...	1·02632	
1 Nov.	315	28 7	16 1	1365	38·5	1·02660	
1 ,,	316	28 7	15 58·5	1430	38·4	1·02664	

tion that the lower temperatures are found nearer the African coast. Omitting a doubtful observation at 2205 fathoms, we have the mean of two observations—36°·41, the temperature at 2132 fathoms; at 1950 fathoms we have 36°·47. The rise of the colder water near the coast is very well shown by the observations between 1700 and 1900 fathoms. The mean of three observations of bottom temperature at depths between 1760 and 1790 fathoms and between longitude 10° and 11° W. is

36·550 F. In long. 14° 1′ W. one observation gave 36°·88 F. as the temperature at 1735 fathoms. Taking intermediate water we have

					Mean.
Depth, fathoms, .	1800	1800	1860	1825	1821
Temp. F., . .	36°·93	36°·88	36°·95	37°·0	36°·94

a mean temperature of 36°·94 F. at 1821 fathoms, which is 0°·39 higher than the bottom temperature in the mean depth 1772 fathoms. Our observations, therefore, show that at depths over 2000 fathoms the bottom water has a high temperature 36°·35 to 36°·47, and a very high density 1·02630 to 1·02660; and there can be little doubt that the excess of temperature and density is due principally to the warm dense water emptied into this part of the ocean by the Mediterranean. When the temperature of the Indian Ocean has been more thoroughly investigated, a region will probably be found in its north-western portion where the overflow of the Red Sea affects the bottom of the open ocean in a similar way. The temperature of the deep water (70° F.) and its density (1·030) are higher than those of the Mediterranean; but on the other hand the dimensions of the Red Sea are much less than those of the Mediterranean, and the volume of its overflow is no doubt also less in a corresponding degree.

In Table VIII. all the temperatures observed during the *Buccaneer* Expedition at depths greater than 2000 fathoms are collected. They indicate a sharp division of the ocean into three basins, the separating ridges of which meet in a point on the Equator somewhere about longitude 13° W. From this point the ridges radiate westward to St. Paul's Rocks, northwards to a point on the Krou Coast about midway between Cape Palmas and Cape Mesurado, and southwards to Ascension. The easternmost of these basins is that of the Gulf of Guinea, and it is intersected by a ridge which probably connects St. Helena with Anno Bom, S. Thomé, and the Cameroon Mountains. The thermometers which were sent down into the very deep water on the west of this ridge were all lost, but the temperatures observed at sounding No. 82 off Cape Palmas show that the conditions of the bottom water are identical with those obtaining in the eastern part of the basin. The mean of the twenty-one observations tabulated gives 36°·402 as the temperature of the water over 2000 fathoms in depth.

Soundings Nos. 408 and 409 are in water which clearly belongs to the great south-western basin of the Atlantic, in the more southern portion of which the bottom water approaches the temperature of melting ice. The *Challenger's* sounding No. 496 is likewise undoubtedly in the same water. The two thermometers sent to the bottom disagree to the extent of 2° F., but neither of them shows a temperature above 35° F.

TABLE VIII.—Temperatures observed at Depths of 2000 Fathoms and over.

Situation.	No. of Sounding.	Latitude.	Longitude.	Depth. Fathoms. D	Temperature. Fahr. at D. T	
Western Basin, Gulf of Guinea.	82	3° 0′·8 N.	7° 43′ W.	2000	36°·51	
	,,	,,	,,	2296	36·54	
	,,	,,	,,	2546	36·47	
	383	5 51·7 S.	8 36·5 E.	2124	36·54	
	384	5 47·7	6 49·5	2038	36·50	
	,,	,,	,,	2279	36·47	
	,,	,,	,,	2538	36·48	
	385	5 50·9	5 1·4	2261	36·33	
	,,	,,	,,	2511	36·42	
	,,	,,	,,	2761	36·30	
	386	5 59·4	3 49·4	2437	36·38	
	,,	,,	,,	2687	36·47	
	,,	,,	,,	2937	36·39	
	387	6 2·2	1 50·7	2200	36·46	
	,,	,,	,,	2500	36·50	
	,,	,,	,,	3000	36·48	
	388	5·58·1	0 1·5	2442	36·48	
	389	5 58·5	1 24·1 W.	2134	36·51	
	,,	,,	,,	2374	36·48	
	403	0 33·3	14 57·4	2115	36·32	
	404	0 26·5	15 10·2	2100	36·42	
North-Western Basin.	*497*	0 15 S.	14 25 W.	2250	36·2	*Challenger.*
	410	1 17·6 N.	13 54·4	2725	36·13	
	411	3 3·4	15 0·9	2611	36·29	
	32	5 48	14 20	2596	36·15	
	31	6 28	13 46	2376	36·24	
	3	7 1	15 58	2584	36·06	
South-Western Basin.	*496*	2 42 S.	14 41 W.	2350	33/35	*Challenger.*
	408	0 7·8 S.	14 28·6	2397	35 62	
	409	0 0·7 N.	13 4	2498	35·57	

On the other hand, *Challenger* sounding No. 497 is equally certainly out of the cold water, the two thermometers showing 36°·5 and 36°·0, and its position is only seven miles from that of the *Buccaneer's* sounding No. 408 above referred to. Hence it is probable that these two soundings, Nos. 408 and 409, are in a narrow hollow at the furthest north-eastern extremity of the deep cold basin of the south-west Atlantic.

To the north-west of the ridges we have a basin where the temperature falls continually as the depth increases, at least to a depth of 2600 fathoms. It is not a little remarkable that in the North Atlantic the deep water, under the influence of the overflow from the Mediterranean, should attain almost exactly the same temperature as the deep water of

the whole of the Gulf of Guinea. The difference in the source of the water in the two localities is, however, clearly shown in the difference of their densities.

When collecting samples of water from different depths, another form of thermometer was used. It is on an entirely different principle, and registers the temperature by being inverted at the desired depth. It is Messrs. Negretti & Zambra's patent, and is a very excellent instrument, and was fitted with the disengaging apparatus devised for it at the Scottish Marine Station at Granton. This consists of an arrangement by which a weight is allowed to run down the line when the thermometer has arrived at the desired depth. It falls upon a lever which sets free the thermometer, which then reverses itself by its own weight.

A curious accident occurred in connection with this instrument. On one occasion the thermometer was sent to a depth of 200 fathoms, and the weight was allowed to slide down as usual. When it came up, a small flat fish, about four inches long, was found with its head firmly jammed between the weight and the lever. The animal seemed to have been examining the thermometer, most probably by touch, and it had just reached the mechanical part of it when the weight descended and crushed its head. It seems hard that creatures living so far from the resources of civilisation should still be exposed to accidents by machinery.

An important part of the *Buccaneer's* work has been the thorough investigation of the distribution of temperature and density in the superficial waters of the Gulf. During the time necessary for making a deep sounding, it was nearly always possible to collect samples of the water and to determine the temperature at five or six different depths down to 100 or 200 fathoms. When longer stoppages were made, the water was explored to much greater depths, and a great number of complete series of temperature determinations have been made.

The Gulf of Guinea and the great Bight formed by the Pacific on the west coast of Central America are *homologous* geographical features,[1] and they present many interesting points of likeness and unlikeness. In their oceanic features they present a marked resemblance; although the Pacific Gulf lies in much higher latitude than the Atlantic one, both of them form the source whence the west-running equatorial currents proceed, and the end towards which the east-running counter-currents tend. In both oceans these currents form the most considerable feature in the circulation of their waters, and it is in the gulfs above named that their rise and disappearance are to be traced. The excessively high temperature of the surface water in both gulfs is due to the fact that both are the receptacles of the waters of the counter-current which have been highly heated by their course eastwards across the ocean at or near the Equator. During the whole cruise of the *Buccaneer*, beginning and ending at Conakry, the temperature of the surface water was never under 80° F., and rarely under 82°, while all along the west coast proper

[1] *Proceedings of the Royal Geographical Society*, 1886, vol. viii. p. 753.

it ranged from 83° to 86° F. On a voyage along the coast of Central America, in April and May 1885, I made a careful set of observations of the temperature and density of the surface water, and with a like result. The temperature, however, rose higher. In the Gulf of Tehuantepec it did not fall below 86° F., and rose in the afternoon as high as 90° F. The high temperature and calm waters seemed to form an attraction for the turtle, which could be counted by scores basking in the sun. Although famous for its turtle, such crowds are never seen in the Gulf of Guinea.

The resemblance, so striking from an oceanic point of view, between the gulfs, disappears in a great measure when they are looked at from a continental point of view. The eastern shore of the Pacific Gulf is formed by a narrow strip of land which furnishes almost no drainage at all. The Gulf of Guinea, on the other hand, is the receptacle of the drainage of three-fourths of the African continent, and especially of the equatorial part, where the rainfall is excessive.

The Niger and the Congo are giants among rivers, and besides them there are numerous others comparable in size with the largest European rivers. The confluence of their waters in this comparatively restricted area produces marked effects on the nature both of its waters and the deposits at the bottom. In no sea does the influence of the coast make itself felt so far from land as in this gulf. The whole of the Bight from Accra to Loanda has been filled up to an enormous extent by the dark-coloured soft muds brought down by the great rivers. Off the mouth of the Congo the shore-mud was distinctly traced to a depth of 3000 fathoms at a distance of 600 miles west of the mouth of the river.

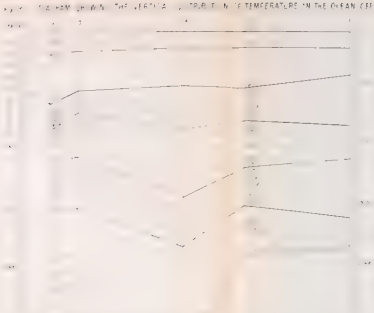
The currents of the sea were the subjects of constant observation, but during the first part of the cruise the cable work occupied all the time, and none could be spared for extended observations. Generally, however, the easterly current was found running all along the coast as far as Accra, and extending seawards to a distance of at least 50 miles from the coast. Between Accra and S. Thomé Island a north-westerly current was experienced. Between S. Thomé and Cape Lopez the current was to the north-east, and further north it came again to the north-west.

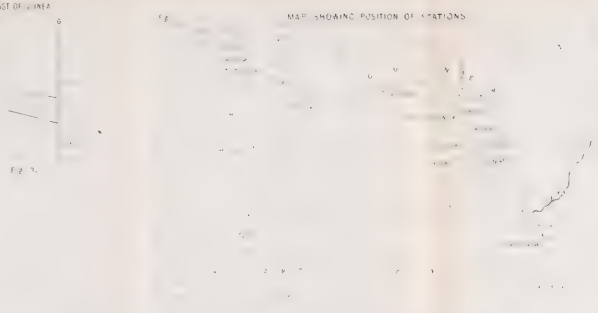
On the way to Ascension the ship was anchored in 1700 fathoms by means of a wire buoy-rope and an ordinary anchor weighing 5 cwts. It had a bag attached to it to receive the mud which it would scoop out of the ground on being weighed. The south-east trade-wind was blowing freshly at the time, but the anchor held the ship perfectly, and the surface current was accurately measured; it was running with the wind to the north-west at the rate of rather over a knot an hour. In heaving in the anchor the rope parted at a flaw caused by a chafe in going out. This was a great disappointment, as the anchor, being fitted as a most efficient mud dredge, would certainly have brought up two or three hundredweights of "globigerina ooze." A course was then steered for Ascension, allowing only one-half of the current which had just been observed, and even this allowance turned out to be in excess of what was required. The ocean currents generally run in streaks, and alter their direction under tidal influences, as was shown by observations on the currents on the "Dacia Bank" in 1883. It was, however, interesting to have been able to make

an exact measurement of the surface drift, at a particular time, apparently caused by the trade-wind. Another and more successful attempt to use the anchor dredge in deep water was made on the 10th of March in the position of an old sounding of H.M.S. *Hydra*, indicating 1600 fathoms, with the bottom "scoriæ and shells." In this position two soundings, at a distance of three miles apart, gave the depths as 1845 and 1892 fathoms, and the anchor brought up from that depth over one hundredweight of very pure globigerina ooze. Here a southerly current of half a knot was observed at the surface, but it reached only to a depth of 15 or 20 fathoms. At 30 fathoms and greater depths a very strong under-current was found setting to the south-east. This easterly under-current was observed and measured approximately on the two succeeding days. It was running at over a knot an hour. It was remarkable that on the run from the Equator to Conakry no easterly current was experienced. The whole subject of currents in equatorial waters is well worthy of extended investigation, and, with proper appliances, it is by no means difficult, and would certainly prove interesting.

In investigating the under-currents, "tow-nets" were frequently used as drags, being attached to a line with a heavy weight at the end, and supported by a "balloon" buoy at the surface. It is an extraordinary thing to see these buoys when cast adrift, going away at considerable speed through the water, and often straight to windward without any visible means of propulsion. In the tow-nets thus used, valuable collections of the life at the particular depth were made. Wherever it was possible these nets were sent to considerable depths, independently of current observations, and regularly at almost every sounding Mr. Rattray used to put over nets at the surface and depths down to 30 fathoms, and keep them out during the time occupied by the sounding. The collections thus made will form not the least valuable of the *Buccaneer's* contributions to science. They were so numerous that most of Mr. Rattray's time, working early and late, was occupied in preserving them. At the same time, however, he was able to submit a very large number of them to a preliminary examination. He finds the most widely distributed organisms on the surface to be the larvæ of Crustacea. They occur both in the open ocean and in the immediate proximity of land. Although not absent in deeper water, they are especially abundant in the layer between the surface and a depth of 100 fathoms, descending and rising chiefly under the alternating influence of light and darkness. When viewed in the mass, striking contrasts were sometimes noticed in the colour of these larvæ, and they were in many instances found to accompany a corresponding variation in the colour of the water. Thus, in areas of green water, as off the mouth of the Congo, most of them were of a green hue, whereas in the open ocean the prevailing colour of a gathering is light red. On the other hand, in the amber-coloured water near the same locality, all the Crustacea assumed a duller red than corresponding oceanic types. This adaptation of colour to surroundings no doubt exercises a protective influence which is of importance to the species exhibiting it.

(*To be continued.*)





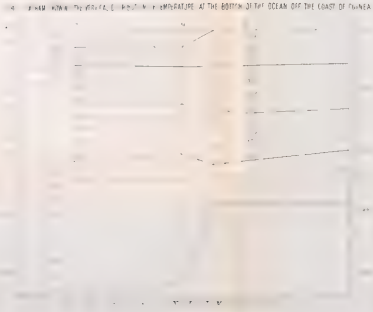
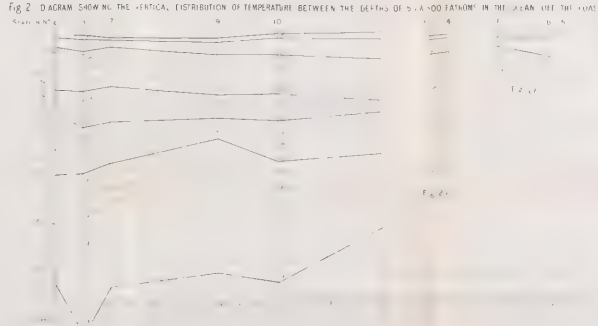


Fig. 2. DIAGRAM SHOWING THE VERTICAL DISTRIBUTION OF TEMPERATURE BETWEEN THE DEPTHS OF 0 & 400 FATHOMS IN THE OCEAN OFF THE COAST OF GUINEA



THE WELLE-MAKUA PROBLEM.

By J. T. Wills.

The destination of this mighty river Makua, it seems, is still disputed. There are three hypotheses, of which two assume that the Makua and Kuta join. By the first the Kuta-Makua flows to Lake Chad, and by the second it flows to the Ubangi (or Mobangi), and so to the Congo. The third makes the Kuta flow to Lake Chad, while the Makua is sent to the Congo. Mr. Jankó (in the *Scottish Geographical Magazine*, vol. iv. page 42 *et seq.*) adds to this third a fourth, viz., that the Werre does not join the Makua, but is the Ubangi; while the Makua flows through Rafai's lake Key-el-abi, and the Loika (Stanley's Itimbiri), and the Kuta is the Shari.

As the Makua or Kuta-Makua is by far the biggest disputed river in the world, and as it may very likely be an open navigable waterway to the country ruled not long since by Lupton and Emin Bey for General Gordon, the matter is worth investigation theoretically and practically.

The objections to the first hypothesis are (*a*) that Lake Chad is not big enough to evaporate away so much water; (*b*) that the Ubangi is too big for the drainage area then left for it; (*c*) that the evidence against any big river further south than the Ardhe joining the Shari is strong and uncontradicted.

The objections to the third hypothesis are first, (*a*) and (*c*) of the last paragraph repeated as respects the Kuta alone; and second, the strong evidence as to the junction of the Kuta and Makua in about 5° N., 22° E.

The objections to Mr. Jankó's fourth hypothesis are fatal. Dr. Junker *has seen the junction* of the Werre and Makua, and told me himself several details about it. Moreover (if more is necessary), Potagos and Casati were both fully and positively informed of this junction before Junker went there. As for the Makua and Loika, the latter, which is not one-third or one-fourth the volume of the Ubangi, is clearly the same as Rafai's lake Key-el-abi.[1] But Rafai or his men crossed the Makua, went four or five days' march across country, and then came up to this lake or broad water, thus distinguishing the two. Of objections against the

[1] For volumes see Grenfell, *Proceedings of the Royal Geographical Society*, 1886, and below. Mr. Jankó says the Ubangi is too small to be the Makua. Granting the general accuracy, however rough, of Junker's mapping, we have first Key-el-Abi, quite close to Lubi Fall, Loika (?(Loi)ka-Lubi=Key Labi); second, the Makua followed down 150 miles beyond Rafai's crossing to the zeriba of Ali Kobbo, whose men had also penetrated four days' march south-west without reaching any Congo or Loika river; and about a year after Rafai and Junker's journeys, Stanley arrives at Loika mouth, and gathers information from friendly natives, who show him unmistakable Khartoum beads got through tribes up stream from white traders from the north. Rafai had a trading station between Makua and Key-el-Abi. These natives, too, know nothing of Ali Kobbo's raids. Also Junker makes it only 100 or 110 miles from Ali Kobbo to the Mbomo (east fork of Kuta), and as much further to Mofio's. Lupton had taken a dozen lunars at Mofio's, fixing the lat. as 6° 23′ N. about, and Dr. Junker's own dead reckoning, thus checked by Lupton, proved surprisingly correct.

second hypothesis (of the identity of the Kuta-Makua with the Ubangi), I really know none. It is said indeed that the area then left to feed Lake Chad would be too small, and Mr. Ravenstein stated this view clearly enough in reply to my paper, *Proceedings of the Royal Geographical Society*, May 1887. We will deal with that matter, along with other questions of river volumes, later on.

Let us first consider such details as we know about the topography of the region between the Makua and the Shari. Our chief authorities are Barth, Nachtigal, Potagos, Lupton, and Junker. Zebehr Pasha might be added to this list.[1]

Barth and Nachtigal saw many people (Mohammedans, not uncivilised negroes), who had crossed the Logon river, and they (especially Nachtigal's informants) asserted that the Logon connects with the Upper Shari, so as to enclose a vast level island some 300 miles long. Above this, says Nachtigal, is the river Ardhe. The identity of the Ardhe with the Shari was probable, but not certain, and no big tributary of any size beyond or south of the Ardhe was known to any one that he met or heard of. Nachtigal engaged as servant a man who had gone south, in about long. 18° E., upon a slave raid as far as the Ardhe and across it. He had *forded* the Ardhe where, by his description, it was not more than 300 yards wide. Its current made fording rather difficult. The other Shari tributaries on his line of march to the north were deep and unfordable, but not particularly rapid, and were pretty generally known to other informants also.

Nachtigal also spoke with, and got a long itinerary from, a Bornu trader, who had gone SSE. or SE. from Runga (11° N., 21° E.) across two of these tributaries, and then (50 miles further) *through Foro*, which was near the sources (as he said) of the Ardhe, till about 100 miles beyond Foro he reached a big river, Kuta, which he said was much bigger than the Shari, and did not run into it, although it flowed west. He spoke the Banda language, and said it was spoken throughout this region from 9° N. to the Kuta. Rimbishe, he said, was a district on the Kuta.

Now Foro (and also Rumbeshe) is identified by Lupton, who went to Foro himself, and sent a man thence WSW. to the Kuta with a watch to time his marches, which amounted to 44 hours odd minutes from Foro to Barusso (Walad Osman's zeriba), on the Kuta. This man reported that a big river joined the Kuta from the south four days' journey down stream to the west.

[1] Barth, *Journal Royal Geographical Society*, 1853, p. 120, Faki Sambo's information. Other itineraries in *Journal Royal Geographical Society*, 1853-55, and see his book *passim*. Nachtigal, *Berlin Geographical Society*, 1875; and see his *Sahara and Sudan*. Dr. P. Potagos, *Dix Années d'Explorations en l'Afrique et en Asie Centrale*, Paris 1885, cited, but apparently not read, by Mr. Jankó, p. 44 *supra*. Zebehr Pasha, *Contemporary Review*, 1887, September-November, and Miss Shaw's fuller MS. notes. Lupton, *Proceedings of the Royal Geographical Society*, 1884, p. 247. Nachtigal and Lupton's information, and other, summarised by me in *Proceedings of the Royal Geographical Society*, 1887, pp. 291-3, 299, 300, and p. 288.

Zebehr also knows Foro. Miss Shaw[1] has it in her list of districts which submitted to Zebehr, along with Adja (Aja) and Marra, which last were not so far west. Lupton passed through them all.

Zebehr says he himself went beyond these districts to Sebanga, Abdinga, and Sakara, making treaties. Sakara (Nsakara) is known to Junker. It lies SE. of Foro, on the west of the Genko (Genko is perhaps Zebehr's Gangua), and its people are distinct in race and language. Sebanga is known to Potagos. From a high hill near the point where the Shari, Nile, and Kuta basins meet in a point, he was shown the rivers flowing south to Sebanga. He met one of Zebehr's agents in 1876, returning with ivory from Sebanga. He was told the rivers there flowed south to the Kuta (Mbomo). On the Mbomo he met Rafai, who assisted him and said that Zebehr had gone to Sebanga by river, descending the Ghenko to the Mbomo, and the Mbomo to the river of Sebanga.[2] The country between these rivers and Foro is Ab Dinga. Bohndorff, Junker's servant, in 1877-78, accompanied slave raids made across it from east to west, and learned that these raids had repeatedly reached on the west a big unfordable river (of Sebanga?), which flowed southwards. Thus the Kuta seems to receive a big tributary from west of Foro.

Finally we have the following narrative from Barth. A certain Faki Sambo, who had written a history of Bornu, and who moreover was acquainted with Plato and Aristotle through Arabic translations which he himself possessed, was well known to Barth, who speaks of him as his friend. Faki Sambo, in 1828-1830, was living in the southern frontier town of Darfur, and accompanied two great slave raids made by the troops of Darfur into this country. The first expedition in 1828 passed through Adja, and other places which we can identify, to the Kuta (Kuta Kubanda or Kuta of Banda as he calls it). The Kuta was so big that men on the south bank "looked like little birds," and the expedition, being unable to cross it, returned.

The second expedition in 1830 went therefore further to the west, in a south-west direction from Adja. On its return, by a route still further to the west, it passed the sources of a river which was then christened *Ardhe*, because it boiled up with earth. Prior to this (and therefore south or south-west of the Ardhe), the army had been campaigning for long (as is described at length) *in a broad, flat, open sandy country where there were nō rivers*, and where the natives were too strong to be enslaved.

Now all these accounts corroborate each other, and the places mentioned in some are surprisingly well identified in the others. I see no reason at present for doubting any of them. That the name Ardhe was adopted in Wadai and Runga from Darfur is not surprising. There was

[1] I quote her MS. notes. Foro, Marra, and Sakara are not found in the printed articles in the *Contemporary Review*.

[2] Rafai himself was a native of these parts west of the Sheuko, and we know his history from 1876 to 1880 from Gessi. He was Lupton's best captain, and hated the Mahdiists for good personal reasons.

a constant trade between Hofrat-el-Nahass (Zebehr's copper mine) on the SE. frontier of Darfur and Runga and Wadai, and Faki Sambo himself, as we see, migrated from near Hofrat to Bornu, while a Bornu trader reached the Kuta. This information shows us a small known river, Ardhe, a broad country without rivers south of it, and beyond or SE. of that the Kuta, not flowing to the Logon or Shari.

As for Potagos, no one can read his book without being struck with his absolute, plain, unvarnished and charming transparent simplicity. What he saw and heard he repeats. Herodotus is his model. His only theory is that the ancient Greeks knew as much about the Sudan as we do. Modern geographical discoveries on the Congo and elsewhere are indifferent to him. I have verified him in numerous minute particulars. He is not a map-maker, and does not pretend to be one.

In addition to these facts we have Dr. Junker's, and Dr. Junker is an excellent map-maker. He saw the Makua near Ali Kobbo's in the dry season, "full of islands, and perhaps 10 kilometres from bank to bank." It was said to flow NW., and to join the Kuta some five days' journey beyond. His routes connect this place with the Mbomo and Ghenko (about 100 miles distant), and with Lupton's astronomical position at Mofio's. They fill in the whole country east of this to the Nile watershed, and pretty well fix the upper south watershed of the Makua.

Moreover, as to the junction of the Makua and Kuta Mbomo, we have Casati's information,[1] gathered from an old Zandeh chief, Negokoto, brother of the celebrated Ntikimma, whose tomb is guarded and kept sacred in Bakangais' country on the Bomokandi. (Ntikimma is probably the Tikima who gave his daughter in marriage to Zebehr.) It is certain that for some generations the Zandehs have been gradually moving eastward or SE. up the N. side of the Makua, and consequently we find their accounts of the country down stream to be consistent, and their lists of chiefs there fairly full. Negokoto told Casati that the Makua joined the Kuta, that the water there was lake like, and that there were boats. Potagos was told this too, and adds that the boats used sails. His "river that comes from Kifa's country" is a clear definition of the Makua. The junction was said to be in the land of Forema. Now Ali Kobbo (or "Alikapou," as Potagos writes it) in 1877 was on the Mbomo preparing to attack the chief Forema, and in 1882-3 was established on the Makua about 23° E. long. Forema, if not killed, had by this time disappeared. Perhaps he had been driven into the tongue of land where the rivers meet. Their junction is not indeed proved, but the evidence as to it is strong, for we have three, if not four, rivers, the Makua, Mbili, Kuta, and Sebango converging in a flat country; two of them are of great width, and one is forming a labyrinth of alluvial islands, and by all accounts these big rivers join apparently four or five days' journey beyond Ali Kobbo's and Wed Osman's zeribas.

[1] *Esploratore* of April 1883, pp. 282, 291, etc., Milan. Compare also page 45, l. 15, of Mr. Jankó's paper with the supplement of the *Esploratore*, May 1887.

As Mr. Jankó affects to doubt Dr. Junker's accuracy and veracity (which require no vindication from me), let us see what is his capacity for correct quotation and intelligible argument. Citing him by the page and line of this Magazine, I find the following statements.

Mr. Jankó: "The Shari is highest in March" (p. 42, l. 16); "the Welle where Schweinfurth struck it had a current of extraordinary rapidity" (44, l. 7); "from Stanley's last letters it is evident that the Aruwimi is the Nepoko" (45, l. 37); "Stanley has followed the Nepoko in 1887 up to its sources" (45, l. 6); "there is a mountain chain on the north side of the Aruwimi through which a river could not pass (Stanley)" (43, l. 17); "the highest point on the Mbomo in the Ndoruma mountains is in 23° E. long." (45, l. 29); "the Ubangi at the furthest known point is 14 to 16 feet deep" (44, l. 16); "it has been ascended as far as 20° 20′ E. long.; here navigation is prevented by rapids, and the river is 19½ feet deep" (46, ll. 6-7).

Now, by all accounts, the Shari is *lowest* in March. Reference to quotations is unnecessary, for March is near the end of the dry season in these latitudes from one side of Africa to the other. Schweinfurth describes the current of the Welle at the place mentioned as "*nothing extraordinary*," (vol. i. p. 550). Stanley has sent *no letters* since leaving a camp just above Aruwimi rapids, and when there said nothing about the Nepoko. What is referred to is obviously the verbal report brought by a deserter, who said that the expedition had found itself upon the Nepoko. The mountain chain referred to can only be the "some hills in the distance" mentioned in Stanley's book (vol. ii. p. 128). The source of the Mboma in Ndoruma's hilly country is about 27° 30′ E. (an error of 300 miles). The Ubangi has only been ascended to 19° 20′ or 19° 30′ E.; the rapids below here were passed by Grenfell without much difficulty, and do *not* prevent navigation, except possibly at some seasons, and the only recorded set of soundings near or above the rapids (Grenfell's) showed an *average* depth when the river was at its lowest not of 14 or of 19, but of 25 feet.[1]

Two remarkable assumptions run through the whole of Mr. Jankó's paper. One is that the Welle is the only river which rises and falls with the season of the year,[2] so that the depths and widths of all other rivers (and indeed of the Welle too, *see* p. 44, top) are stated (as those of the Mobangi quoted above) without reference to season or time of year.[3] The second assumption is that rivers have uniform velocities, or each one a

[1] Grenfell, *Proc. Royal Geogr. Soc.* 1886, a paper which Mr. Jankó has evidently not read, for Grenfell's measurements show a volume of about 100,000 c. feet for the Ubangi at its lowest at this place, while his estimate by measurements of that of the Loika is only 30,000. Mr. Jankó decides against the identity of the Makua and Ubangi because the Ubangi is too small (p. 44, top), and thinks the volumes (that is to say *widths*) of the Welle-Makua and Loika agree very well!

[2] *See* p. 48, l. 4 from bottom: "Since that phenomenon" (the rise and fall of the water in the river) "has only been observed in the case of the Welle." But the Shari is apparently also excepted as a variable river (see above).

[3] *See* p. 44, ll. 11 and 16; p. 45, bottom; and 46, top, etc.

uniform velocity of its own, so that cross sections alone are spoken of as measures of volume, and indeed as synonymous with volume,[1] as for instance the Itimbiri (Loika) "varies in width from 750 to 870 yards," *which corresponds to the volume* of the Welle. Velocity of current as a factor of the amount of flow is ignored, and the only mention of it that I find is that above mentioned of the "extraordinary" velocity of the current of the Welle, from which it is argued that the Welle cannot join the Shari, for the Shari is highest in March when the Welle (at long. 28° E.) is lowest, while "the current of the Welle is sufficient to traverse the distance between the nearest observed points of the two rivers in the space of twenty-two days," which would cause a nearly simultaneous rise and fall.[2]

That is to say, if the Welle is, as alleged, of extraordinary velocity at one spot, it must needs traverse 1000 miles of unexplored country without reference to the slope of the ground (which happens to be less than a foot a mile between the points so observed) *at a certain rate!* The effect upon the rise and fall of the Shari of tributaries draining of necessity a much greater area than Schweinfurth's Welle is to be taken as *nil* too, "because this phenomenon of variation has only been observed in the Welle"!

It is scarcely necessary to dissect the reasons from which we are asked to infer that Dr. Junker is the person whose "data with respect to facts which we have no means of controlling, likewise deviate considerably" from the truth, and who "it is to be hoped will in future pay more regard to the existing literature on this subject and to the cartography of the same."[3] One of them is that Dr. Junker adopts Grenfell's mapping of the Congo, while the Gotha map still reproduces[4] Stanley's, which has in fact been found much the more incorrect of the two. Another is that while Lupton and Junker differ as to the precise latitude of the Kuta, Nachtigal agrees with Lupton and not with Junker. As a matter of fact Nachtigal mapped the Kuta exactly in the same latitude as Junker does, differing from Lupton; but why he should judge between them is not clear, for he was never within 400 miles of the Kuta himself, mapped it at a shot from the itinerary of his Bornu trader, and says that he does not know if this man went in a straight line or in a zigzag, but knows only his itinerary, and his description of the big river Kuta, which he said did not flow to the Shari.[5]

Let us now consider the question of comparative volumes and drainage areas, and the merits of the first and second hypotheses.

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[1] *See* p. 43, l. 7 from bottom; 44, ll. 10 to 20; 48, l. 27 (quoted), and elsewhere.

[2] P. 42, ll. 17, 20, and p. 43, l. 17.

[3] Page 47.

[4] But with an apology, admitting that astronomical observations prove Stanley wrong and Grenfell very nearly right, and pleading in excuse that corrections of this plate or stone have already been endless. See preface to 2d edition of this sheet of the Gotha map.

[5] Mr. Janko is evidently (from p. 47, line 5) not aware of Lupton's paper in the *Proc. Royal Geogr. Soc.* 1884, and (from the Makua and Lake Key-el-Abi hypothesis) also not aware of his former communications in it, and in Petermann, about Rafai. Potagos' book is also misquoted, for it does not say that Potagos reached Ingimma, a place on the banks of the Werre, but only that he reached Ingimma's *territory*, which extended *beyond* to the Werre, which river he says he did not see. Casati is also misquoted at p. 45, line 15.

In the first place, if the Kuta-Makua (or Kuta alone) flows to Lake Chad, it must pass into, or else south-west of, the Ardhe. It cannot flow *into* it, for a fordable river 300 yards or mètres wide can only pass 20,000 cubic feet of water a second. With such a volume it would be 1000 feet wide, four in average depth, and 5 feet a second ($\frac{5\times2}{3}$ miles an hour) in average current, or 5 feet in depth and 4 in current. Depth and current are never uniform, but increase at some one and the same place, and those above-mentioned would be difficult enough to ford. Besides, if the Ubangi in its lowest season has five times this amount of water it would require a proportionately large drainage area, which is not to be found on the map upon this Kuta-to-Ardhe hypothesis.

If the Kuta went *round* the Ardhe, especially if Faki Sambo's wide riverless country is regarded, it would figure very strangely on the map in the long narrow space between the Ardhe and the Ubangi-Makua, and it would end, against all the evidence, in the river of Logon or near the apex of the island between the Logon and Shari. If we admit that the Makua joins the Kuta, then the impossibility of finding feeders for the Ubangi is intensified, and if Grenfell's measurements of the Ubangi are thrown overboard too,[1] the following calculations will serve, I think, to show that this Makua-Shari hypothesis is wrong. They are based on the evaporation and area of Lake Chad, upon the position of the great watersheds of the continent outside the disputed area, and the sizes of the Nile and Congo, all of which are tolerably well known. Let us use, in respect to them, these units: for areas, square degrees (at the equator), and for volumes, thousands of cubic feet a second. 1000 cubic feet a second = 2·856 inches of water annually flowing off the surface of 1 square degree. The ground for argument here is broader and more secure.

Omitting for the moment the proof of the various numerical items and estimates used, the calculation, as it seems to me, may be expressed thus:—

The evaporation on Lake Chad equals 60 volume units of average inflow, *at the outside.*[2]

The discharge of the Congo at Nokki, or at Stanley Pool (it matters not) is calculated at about 1500 units, and may safely, I think, be assumed to be over 1200.

That of the Nile at Cairo is 105, if not more, and if so then at Khartoum (together with that of the Atbara, which comes in below) is at least 130, while at Lado it is only 20. The Blue Nile and Atbara together contribute on the yearly average at most rather less than the

[1] There is no reason for doubting them. Grenfell is the most careful observer by far upon the Congo. Belgian data are of quite a different order. As he went up he saw how the water had fallen, and was still falling; as he came down it was beginning to rise. Another objection to the Kuta-Shari theory is the size of the Logon; it is about half as big as the Shari. With a Kuta added to the Shari it would require a proportionate increase of basin too—which the Ubangi basin cannot, on that hypothesis, afford to give away. Here, and in the text above, I am also meeting the contention that the Kuta alone may flow to Lake Chad.

[2] Even Mr. Ravenstein, *F.R.G.S.*, 1887 (p. 303-4) claims no more. His statement, p. 304, l. 8 is, however, incorrect: see *Ibid.* p. 299, ll. 10 to 14.

White Nile. The probable error in these estimates is not very great, and the figure for the Nile at Cairo is really known with some exactitude.

The Lake Tanganika basin for many years, and from beyond the memory of the inhabitants, never discharged water to the Congo, and the amount now and for the last ten years so discharged is not much. Say 10 units, the figure matters little.

I make the remainder of the Congo basin within the limits assumed (and marked) on the second edition of the Gotha map—which include the Kuta-Makua—to be 270 square degrees or 268 units (degrees at the equator). Discharge therefore at 1500 units of volume = 16 inches depth of rain-water per annum flowing off the whole.

Discharge into Lake Chad, from the "contributing area" defined below, of 51 units of area at the outside of 3·37 inches. *If the Makua basin is transferred* from the Congo to Lake Chad, however close it is cut off on the west, these figures become :—

For the Congo basin, $18\frac{1}{2}$ *inches of rain* running off.

For the Chad basin, *only* 2·12 inches.

With which compare (1) for the Nile basin between Lado and the latitude of Khartoum—that is to say, for the White Nile between Lado and Khartoum, with the Blue Nile and Atbara altogether—$3\frac{1}{2}$ *inches* running off the whole "contributing" area.

Or, separately, about $5\frac{1}{2}$ *inches* almost by the Blue Nile and Atbara,

And about $2\frac{1}{2}$ *inches* by the White Nile at the least.

(2) For the basins of the great lakes, Tanganika, Victoria Nyanza, Muta-Nzige, and Albert Nyanza, adding the two small discharges at Lado and at Lake Tanganika to a very moderate estimate of evaporation on known lake areas,—

About $8\frac{1}{2}$ *inches* running off the land into the lakes and river.

Errors of 10 or 20 per cent. in these totals, and much larger errors in small items, really matter very little ; for we have these amounts of rain discharged into and by the rivers,—

Congo basin, $18\frac{1}{4}$ *inches :* and $14\frac{3}{4}$ as a minimum if discharge is cut down from 1500 to 1200.

Lake basins, $8\frac{1}{4}$ *inches* at least.

Blue Nile and Atbara, $5\frac{1}{2}$ *inches* } and probably the figures should
White Nile, . . $2\frac{3}{4}$ *inches* } be 5 and 3, or over 3.
Lake Chad, . . 2·1 *inches at the outside.*

The reason for the small discharge of the White Nile, and the comparison to be drawn between its "contributing" basin and that of the Lake Chad (excluding the Makua basin) can be noticed later.

The main point is this: the Makua-Kuta basin is certainly far richer in rain and running water than the opposite Bahr Gazal slope, which itself is the best contributing part apparently of the White Nile basin below Lado. The rain comes from the south, and the Makua drains the southern or wet, and the Nile the lee or dry slope. We know the rains and high water of the Makua basin last much longer, and we know the

difference in vegetation between one basin and the other. Indeed, so far as we know, the Makua Basin is pretty near as rich in running water as the average of the Congo basin.

At any rate, as it lies wedged in between the lower White Nile basin and the main Congo basin, we may assume that its rainfall (seeing that the watershed between Makua and Congo seems to be so low) is a rough mean between the rainfalls of the basins on either side; and allowance must too be made for the White Nile's contributing area lying wholly on the dry side of a ridge.

But if 10 inches, say, of rain ran off in the Makua basin, it would from 30 squares send 105,000 cubic feet of water a second at least (across long. 20° E., at about 6° N.), if it flows to Lake Chad, or to the Ubangi at Grenfell's furthest (from the basin ordinarily assigned to it) just about 128,000. These figures fit the Ubangi (as far as we know its size) very well; but they do not at all suit Lake Chad, whose area[1] and rate of evaporation would have to be increased against all possibility.

[1] For we have in this case to evaporate away not 60,000 c.f.s. at the outside, but 165,000 c.f.s. at the least; which is impossible. Nor can the above factor (10 inches) in Makua basin be reduced without ignoring the Ubangi. For at this rate the whole of the rest of the unexplored country N. of 2° N., and E. of 12° E. right up to Ngaundere (33 squares), would only give 115,000 c.f.s., and would have to feed the Ubangi at 4° 15′ N., and its two big tributaries lower down, and the French tributaries Likuala and Sekoli too; while there is strong evidence that some of this area on the SW., and much of it on the NW. drains to the coast. If this area were wetter, the Logon basin would be much wetter too, as could be easily shown. Therefore the Makua cannot flow to Lake Chad, and must flow to the Ubangi. One might indeed assert that if the Makua ever flowed to Lake Chad, it would have probably submerged the whole level "island" between the Logon and Shari, and would have overflowed thence by the Tuburi swamp and Mayokebbi depression (altitude about 300 mètres) into the Binue. And if one is to deal with such hypotheses one might add that this depression looks like an overflow of this kind, that the level "island" looks like a dry lake-bed, and that the gorge cut through a rocky ridge of some height by the Mobangi at 4° 15′ N. is so far recent that great rocks still lie uneroded in mid-channel, and that the river still has a sharp fall and a very strong current there in flood, while the altitude of the river there is about 100 mètres above that of the Tuburi swamp, while we know of no high ground between the Kuta and Ardhe, but only of a flat sandy plain without rivers.

The assumptions contained in the figures used above, are as follows:—

Chad Basin.—Contributing area bounded west by long. 13° 10′, north-east by a line from the SE. corner of the Lake to Hofrat-el-Nahass, and south (when excluding the Makua) as marked on the Gotha map.

Lake Chad.—Area taken from Nachtigal, 27,000 square kilomètres, or 10,700 square miles, with deduction of 5 per cent. for islands. Islands cover a good deal—the most recent writer on African lakes, Dr. R. Sieger, writing without any theory to support of this sort, thinks they may be a much as one-third of the whole area. Evaporation assumed at 110 inches, against 30 in rainfall. The rainfall observed at Kuka (to windward of the lake) was 33 inches.

For evaporation compare the following:—India (Bombay Deccan) Ashi tank or lake Sholapur, of 4 square miles, 3 ft. 8 in. in six dry and hot season months—December-May, 1881—eight on a smaller 100-acre tank, 4ft. 4in. in eight months—October-May. Amount carefully estimated from similar data by Jackson for the climate of Akola (Berar), 70 inches a year. Wan Wyck's Vley (reservoir) Cape Colony, near Orange river in the desert, 80 inches a year, or 10 inches a month recorded in the height of summer. Rainfall there six or eight inches. The recorded amounts for these reservoirs or tanks includes loss by *soakage*, and refer to the *first* seasons that the tank was filled. Evaporation of Caspian is estimated

A fair comparison may be drawn both as to climate and drainage between the Lake Chad basin and the White Nile basin below Lado. Mr. Ravenstein has said that the Shari most probably loses in volume in its large alluvial plains. Perhaps it does:[1] but then the Bahr Gazal and White Nile do so too, much more. Beyond the Logon, Bahr Batchikam, and Shari, which seem to make the "island of alluvium" above-mentioned, Barth's native itineraries indicate rock and hilly ground in many places near these rivers, thus limiting the supposed alluvial area.

The area between the Logon Shari and the Batchicam as mapped may be all flat, but it is not flooded as the Nile and Bahr Gazal flats are. If it was, it would not be inhabited to the extent it is. We do not hear of great inundations. Wherever seen, the Logon and Shari have a fair average current. In the Nile basin the extent of flat is better known; it appears to be nearly twice[2] as large as the Batchicam-Logan area (as

by Woiekoff from recent data of the volume of the Volga at about 40 inches. Ordinary evaporating gauges are no guide to evaporation from big lakes; the larger the area the less is the rate. See also as to variation with temperature, etc., the observations and diagrams in the Report on Conservation of Water, New South Wales Votes and Proceedings, 1886. The damp season around Lake Chad lasts three or four months. I think the rate assumed, 110 inches, is excessive.

Congo.—Volume, 1,500,000, or at least 1,200,000 c. f. s. Stanley estimated the volume at Stanley Pool, on April 20, 1883, at 1,430,000 (see for details *The Congo*, i. p. 402); Chavanne, that at Nokki, where the estuary begins, in early June, at 1600 odd (Petermann's *Mitteilungen* 1888, Jan., Literaturbericht, p. 5). He thinks this gives the mean, and Stanley puts the mean rather above his own figure, and after its date: the river rises in April, and reaches the height of its smaller or spring flood about the end of May.

Congo and Lake region watershed is assumed from the Lukuga north, along long. 29°, to the Equator, and thence nearly NE. Muta-Nzige is assumed to drain to the Nile, for Tippu Tib affirms that he saw it, and that his men navigated from one lake to the other. The issue is nowise material to the argument.

Lake Region.—Basin assumed at 58 square degrees of dry land and 10 of lakes. Discharge of Lukuga at 10,000, and of Nile at Lado at 20,000 c. f. a second. Evaporation at 40 inches in excess of the rainfall on the lakes. Tanganika, in particular, lying in a depression, is tremendously hot, and probably evaporates more, and if the evaporation of Lake Chad is 80, this figure (40) might be raised considerably.

Blue Nile and Atbara contributing area includes the Gash basin (which adds little to the Atbara), and is bounded N. and NW. by a line, Gossejeb to Abu Harras, thus including a large area of flat absorbent soil, which in reality contributes very little.

White Nile.—Contributing area bounded north by lat. 10°.

Nile.—Loss between Khartoum and Cairo, see Baker, *Proc. Inst. Civil Engineers*, vol. 60, p. 367-374. "No doubt 20 or 30 per cent. of the Nile is lost by evaporation and irrigation between Khartoum and Cairo." Below Wadi Halfa it must lose quite 20,000 c.f.s. or 20 units. See Baker for volume at Cairo.

White and Blue Nile Volumes.—The maxima and minima of each at Khartoum were measured by Linant Bey and by Schuver. Prussenayre also made estimates on the Blue Nile, and we can compare the periods of their rise and fall.

Nile at Lado.—Lombardini's estimate, and subsequent data by Gordon, Baker, etc. A rough estimate is sufficient. The Sobat is estimated at only some 35,000 c. f. s. in flood, and at 3000 in the lowest season.

[1] I agree with Dr. Schweinfurth that the existence of an island of alluvium 300 miles long is problematical and *primâ facie* unlikely. But even granting its existence, I say, the Welle-Shari hypothesis can be disproved.

[2] See my map, *Proc. Roy. Geog. Soc.*, 1887, and Marno's articles in Petermann's *Mitteilungen*.

it is mapped). Petherick's book gives a map of the immense area under water on the Bahr Gazal and Bahr Jebel in 1863. Zebehr's story of his voyage on the Bahr Arab gives us an extent of the inundations there. At 25° E., this river is only 200 feet above Khartoum, and the floodable flats extend beyond Hofrat.[1] The loss of water in this region of the sudd must be very great indeed. Some rivers, like the Rohl and Rodi, simply spread themselves over the land, and have no channels. The Nile stagnates, and cannot carry these waters off. All the way down to Khartoum it continues to ride on its own alluvium, and to flood its bottom lands as it does in Upper Egypt, losing probably more than it gains. This is the reason for the small discharge of the White Nile.

As for the areas not classed as contributing, they seem in the White Nile and Chad basins to balance each other. Lake Chad probably gets as much or more from W. of long. 13° as the White Nile does from Kordofan, etc., N. of lat. 10°, which last is very little.

The mountains of Darfur certainly contribute to the Bahr el Arab, but it is fair to suppose that they and their western outliers also send as much in proportion to the Shari. Their E. side is certainly not wetter than the W. Further south too, in the Shari basin, in and about Runga, and the southern Aukadebbe basin, there are several hilly regions spoken of.

The mean latitude of the Shari basin is rather higher than that of the White Nile from 10° N. to Lado, but then the lines of equal rainfall are apparently inclined too. Kuka, on Lake Chad, has 34 inches. El Obeid, in the same parallel, has 15 only, and is in fact in the desert. The Atlantic rains reach over Bornu and the lower Shari-Logon basin. As far as I know, therefore, the rainfall of the two basins is apparently about the same.

[*Note by the Editors.*—Since the above was in type, the *Mouvement Géographique*, in a special issue on 18th March, states that a telegram has been received in Brussels from Governor-General Janssen announcing the definite solution of the Welle problem. This telegram says that the Mobangi, or Ubangi, above the Zongo rapids, flows from the east to the west between the 4th and 5th degrees of north latitude; that Captain van Gèle (an officer of the Congo Independent State) has ascended the river to the 22d degree of east longitude, where he was able to confirm its identity with the Welle-Makua of Schweinfurth and Junker. Captain van Gèle, although he reached to within one degree of Dr. Junker's furthest, "on very much about the same latitude," unfortunately turned back: thus leaving a short distance of the river's course unexplored. More definite information is required to confirm this important news from the Congo.]

[1] Purdy, Potagos.

RECENT BOTANICAL EXPLORATION OF ARABIA.

By Dr. G. Schweinfurth.

A hundred and twenty years have elapsed since Forskal, a pupil of Linnæus, first took up the botany of Arabia, and sixty-six years since his sole successors, Ehrenberg and Hemprich, following in his footsteps, collected fresh and important data regarding the geographical distribution of the flora of the region. Since then no botanist of note has selected as his field of research the interesting district which links Abyssinia with E. and S. Africa on the one hand, and India on the other. Such casual additions to our knowledge of its botanical features as have from time to time been made, are due to the observations of travellers, such as Anderson, passing through Aden on their way to India.

Last summer, however, a French botanist, *M.* Albert Deflers, set himself anew to the exploration of Forskal's territory, with important results. Whereas Forskal and Ehrenberg were obliged to confine their observations solely to the Tehâma—the low-lying belt of land along the coast between Lohaja, Hodeida, and Taëz,—that is, to the lower slopes of the mountains, *M.* Deflers explored the highlands of Yemen to an altitude of 8000 feet above the sea, and everywhere had opportunity for collecting the most interesting information.

The country explored by Deflers was much the same as that traversed by Edward Glaser in 1883-85. The former, however, entered many new districts lying mostly to the north of Sana, between 43° 30′ and 44° 30′ E. longitude, and to the south towards Aden. According to Deflers, Glaser's map, forming Plate I. in *Petermann's Mitteilungen* for 1886, is highly trustworthy, and very accurate as regards names and distances. Deflers' botanical collection has been sent to the *Jardin des Plantes* in Paris, and will form the subject of a treatise to be shortly published.

M. Deflers, who some years ago made the flora of Aden and its surroundings the subject of exhaustive study, now intends re-visiting the S. Arabian highlands, with a view to continuing his botanical researches.

Notwithstanding his letters of introduction from Constantinople and from the Turkish authorities in Yemen, *M.* Deflers met with many difficulties in passing through the country; but he speaks of the inhabitants of the highlands and of Tehâma as extremely friendly in their attitude towards Europeans. A sufficient proof of this statement lies in the apparently trifling, but to the student of Eastern manners and customs highly significant, fact, that everywhere the French botanist wore European dress, even to the hat which from afar marked him as a foreigner.

Commercial transactions, requiring frequent journeys to Aden, have brought the inhabitants of Yemen to a certain degree within the sphere of European influence. The contrast between Turkish despotism and British liberty—between abuse of office on the one hand, and justice and order on the other—leads to comparisons in the native mind distinctly favourable to European modes of administration; the practical outcome of which, so far, has been to lend an unusual degree of warmth to the reception accorded to European travellers. Nowhere does one find the signs of fanaticism, the hatred of foreigners, one has been led to expect, but everywhere a desire to welcome and do honour to visitors from Europe.

The flora of the highlands of Yemen is generally allied to that of Abyssinia, the greater number of characteristic genera being common to both. S. African types are also numerous.

Arabia constitutes a part of the El Dorado of the ancient Egyptians. Alike in commerce and in war it was their field of romantic adventure. The same name has been given by the old Egyptians to the regions lying to the E. and W. of the Straits, both of which maintained for centuries their celebrity as the chief source of the world's wealth in spices, precious woods, etc. The coveted vegetable products of Arabia were carried by order of the old kings to Egypt in jars and vessels of various kinds, and many characteristic Arabian species found their way to the land of the Sphinx as exotics for the beautifying and enriching of the temple gardens. Many of the most important cultivated plants of Egypt, originally unknown to the ancients, were doubtless derived from the same source. Such, for example, are the pomegranate, the sycamore, the aloe, and perhaps the well-known *Lawsonia*, the leaves of which have always been much prized for dyeing the hands and the feet. Among the mountains at Taës *M.* Defiers also found the Carob bean (*ceratonia siliqua*) under conditions which point to S. Arabia as the original habitat of this plant, so widely diffused in later times through the agency of the Arabs.

Not only is the study of the flora of S. Arabia important, therefore, as bearing on the question of the geographical distribution of plants, but it also throws a certain amount of light on the origin and history of various cultivated species of the highest importance in the maintenance of many peoples.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Aberdeen Branch of the Society held a meeting on Monday the 27th February, Mr. David Stewart of Banchory presiding. Professor Ramsay, of Aberdeen University, read a paper on *Asia Minor*, which elicited an interesting discussion. Professor Pirie moved, and the Rev. George A. Smith seconded, a vote of thanks to the lecturer.

A meeting of the Geographical Club was held in Edinburgh on Saturday evening, the 25th February, when Mr. H. M. Cadell, of Her Majesty's Geological Survey, submitted for discussion a paper on *The Utilisation of Waste Lands at Home and Abroad*.

A lecture on *Geography in its bearing on War and Foreign Policy* was given to the Society in Edinburgh on the 24th February by Colonel J. Frederick Maurice, R.A. Mr. James Currie presided, and Mr. William C. Smith moved the vote of thanks to the lecturer. Before the meeting separated, Dr. Paterson, of Bridge of Allan, exhibited an atlas containing a most valuable collection of old maps.

On Monday, 7th March, at a joint meeting of the Glasgow Branch of the Society and the Philosophical Society of Glasgow, Dr. Russell presiding, Mr. John Galloway read a Paper on *The Platte River System*. A vote of thanks was awarded to the lecturer on the motion of Dr. Thomas Muir.

The Society's Examinations were held on Saturday, 3d March, the results of which will be given in the Magazine for next month.

GEOGRAPHICAL NOTES.

EUROPE.

Physical Surveys of Swiss Lakes.—Our eminent Corresponding Member, Professor Paul Chaix of Geneva, has favoured the Society with the following interesting account of recent work in determining the configuration of deep lakes, based on the reports of M. J. Hörnlimann, of the Federal Topographical Survey.

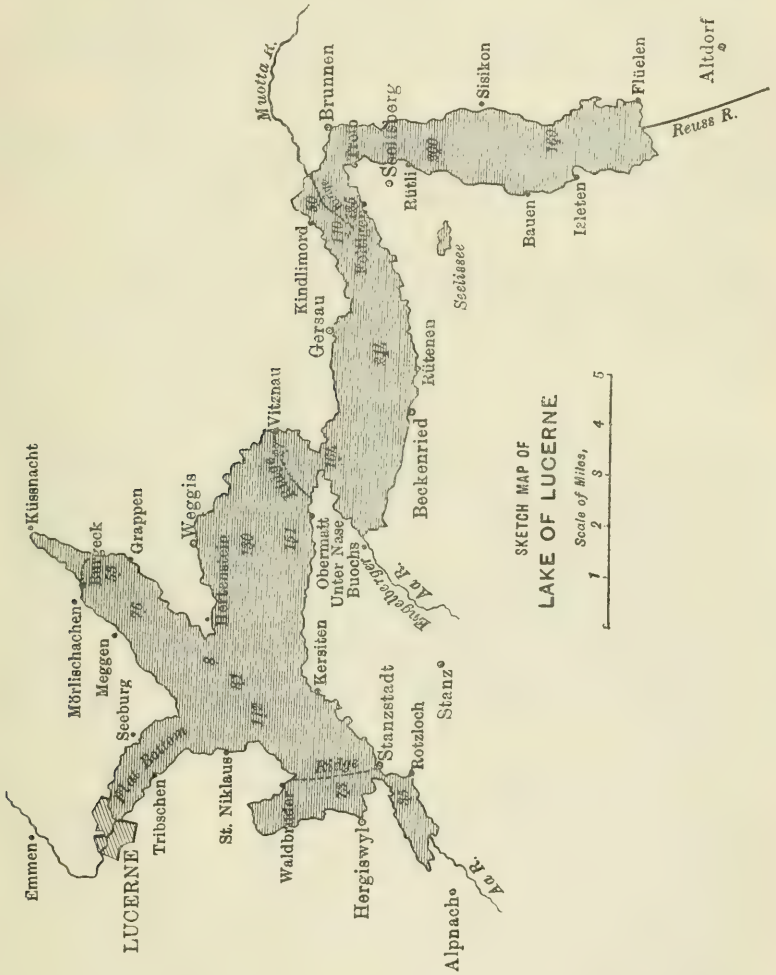
The first official survey of the depth of lakes was that of the Lake of Zurich in the years 1853-54, under Engineer H. Denzler. Similar work was carried on up to 1866 in the smaller basins of the lakes of Thun, Brienz, and Bienne. From 1873 to 1886 operations were extended to many others; the eastern half of the Lake of Geneva, Lake Morat, the Greiffensee, and Lake of Pfäffikon, in the Canton of Zurich, Lake Neuchâtel, the Untersee, or western part of the Lake of Constance, the Wallensee, improperly called Lake of Wallenstadt, Lake of Halwyl, in Aargovia, and that of Egeri, in the Canton of Zug. During the last three years Colonel Lochmann, head of the topographical staff, has been engaged in researches on the depths of the lakes of Constance, Geneva, Zug, Lucerne, Sempach, and Baldegger, in the Canton of Lucerne.

As a rule, lines of sounding are run parallel to the shore, about 200 or 500 mètres apart; but in places where there is an abrupt descent of the bed of the lake this distance is reduced to 80 or even 30 mètres. This is usually required off headlands, coves, and the entrances of streams. In most of the lakes there is a sudden increase in the slope at some distance from shore, and in some cases a zone of nearly uniformly shallow water runs out to where the abrupt deepening occurs. This is called *Wysse* (white), apparently derived from *Weiss;* and on the south-east margin of Lake Neuchâtel it goes by the name of *fond blanc*. The first exploration of this lake, by Guyot and Count Pourtalés, revealed the existence of isolated submarine islands or banks, detached ravines and hollows filled or lined with rolled pebbles from torrents.

The discovery of peculiar channels, ploughed like furrows in the bed of the lake, where the Rhine and Rhone entered, made it necessary to greatly increase the number of soundings. The average of 20 to 30 per square kilomètre was raised to 37 in the Lake of Lucerne. The activity with which proceedings were carried on may be judged of by the following figures. The monthly average occasionally exceeded 1300 soundings. In the case of the very irregular basin of the Lake of Lucerne 4292 measurements of depth were made within ninety-two days, giving a daily average of about $1\frac{1}{4}$ square kilomètres covered, as the area of the lake is $113\frac{1}{2}$ square kilomètres. In a part only of the Lake of Constance (Bodensee) there were 3850 soundings, in the Lake of Zug 1232, the Lake of Sempach 627, Lake of Baldegg 428, and Lake of Geneva (eastern basin) 2430.

The vessel employed for sounding was a boat about 10 mètres (33 feet) long, half-decked, and manned by three or four rowers. On the fore-part of the deck a mast 7 or 8 mètres (24 feet) high was erected, and in order to facilitate the calculation of distances this was graduated in decimètres. The sounding apparatus was fixed a little abaft the centre of the boat; the line came from a drum through a block hanging over the side, and passed through a perforation in a horizontal iron plate fixed to the gunwale. Care had to be taken that the line hung perpendicularly, and was not changed in direction by wind or currents.

The cross sections were run alternately in opposite directions; one from Romanshorn to Friedrichshafen, for instance, or from St. Gingolph to St. Sapharin, a distance of 9 kilomètres, occupying a whole day. An ingenious system of signalling with variously coloured flags was employed, by means of which the course of the boat was kept straight by observers on shore. The exact position of each sounding was determined by angles measured with the sextant or plane-table to three fixed points, or, in calm weather, to two.



The sounding-line employed by Colonel Denzler on the Lake of Constance was at first of silk, 8 millimètres (0·3 inch) in diameter, and strong enough to support 70 kilogrammes. A hemp line steeped in oil was then used on the Lake of Lucerne; it was 4 mm. (0·15) inch in diameter, with metallic divisions at each 5 mètres, and a peculiar mark at every 50. With this line bottom could be touched at 200 mètres (109 fathoms) in 80 seconds, and the line reeled in in

2½ minutes. The friction was still considerable, and finally, in the Lake of Geneva, a steel wire was adopted, 0·9 mm. (0·035 inch) in diameter, and supporting 100 kilogrammes (220 lbs.). It weighed 5 grammes per mètre, *i.e.* 600 mètres did not exceed 3 kilogrammes in weight (328 fathoms weighed under 6½ lbs.). To preserve the wire from rusting it was kept during working hours coiled on a roller in a dish of oil, and after use was rubbed dry, and packed in an oiled bag. The depth is, by this means, obtained much more accurately than with a line of any fibre; but it is not to be wondered at that the wire occasionally gets entangled or kinked, and breaks when it is used many thousand times in succession. A weight of 5 kilogrammes (11 lbs.) was generally used in lakes of slight depth, and increased to 9 kilogrammes (20 lbs.) for the Lake of Constance.

The very numerous and accurate observations of temperature at great depths in the Lake of Geneva have led to the following conclusions. From the surface to a depth of 30 mètres (16½ fathoms) the diminution of warmth is rapid, then becomes much less as the depth increases; thus—

	M.	F.	M.	F.	M.	F.	M.	F.
Depth (mètres and fathoms),	0	0	20	11	30	16½	240	131
Temperature (C.° and F.°), .	19·7	67·4	18·1	59·2	9·9	50·0	5·9	42·6

Professor Fr. Forel, explains the groove hollowed out in the Lake of Geneva, opposite the entrance of the Rhone, by the descent of cold, and therefore denser, river water to the bottom of the basin, and its erosive action on the silt in the line where the strength of the stream is greatest. This explanation is in perfect agreement with Mr. Buchanan's (*Scottish Geographical Magazine*, 1887, p. 223).

The complicated form of the Lake of Lucerne is very interesting. It contains at least five basins of different depth, divided from each other by ridges, the most remarkable of which, formed not of mud, sand, or gravel, but the stony material of a moraine, stretches between the bold headlands of Ober and Unter Nase, a little to the north of the narrowest part. Following is a statement of the greatest depths in each of the Swiss lakes as ascertained by the recent surveys :—

Name.	Mètres.	Fathoms.
Lake of Constance (Bodensee), between Uthvil and Friedrichshafen, ...	255	139½
Lake of Geneva (Genfersee), upper part, between Rivaz, St. Gingolph, and Villeneuve, 1½ kilom. south of Rivaz, ...	256	140
Lake of Geneva, central part, between Ouchy and Evian, ...	310	169½
Lake of Lucerne (Vierwaldstättersee), between Gersau and Rütenan, ...	214	117
Lake of Zug (Zugersee), between Walchwil and Immensee, ...	198	108¼
Lake of Sempach (Sempachersee), between Eich and Nottwill, ...	87	47
Lake of Baldegg (Baldeggersee), between Rettschwill and Gölpi, ...	66	36

Name.	Mètres.	Fathoms.
Depths ascertained previously.		
Lake of Brienz (Brienzersee),	261	143
Lake of Thun (Thunersee),	217	118½
Lake of Neuchâtel (Neuenburgersee),	153	83½
Lake of Wallenstadt (Wallensee),	151	82½
Lake of Zurich (Zürichsee),	143	78½
Lake Egeri (Aegerisee),	84	46
Lake of Bienne (Bielersee),	78	42½
Lake Morat (Murtensee),	49	26¾
Lake Hallwyl (Hallwilersee),	48	26
Lake Constance (Untersee),	47	25½
Lake Pfaffikon (Pfäffikersee),	36	19½
Lake Greifen (Greifensee),	34	18½

M. de Sinner of Bern has described the site of a cluster of fifty erratic blocks of granite, gneiss, mica-slate, and conglomerate, which were formerly submerged in the Lake of Neuchâtel, but have now been exposed by the artificial lowering of the level.

At a meeting of the Swiss Society of Natural Sciences, in August 1886, M. Edw. Sarasin, secretary of the Geneva Natural History Society, showed a series of photographs taken by a self-registering apparatus he had established on the shores of the Lake of Zurich, which prove that *seiches* do not occur on that water. A probable explanation of this is the presence of the raised bank or bar across the lake at Rapperschwil.

ASIA.

Island of Nias.—Signor Elio Modigliani has contributed to the August and September (1887) issues of the *Bollettino della Società Geografica Italiana* a long and elaborate account of the island of Nias, in which he describes in detail its geographical position and surface, its orography and hydrography, and treats of its plains, its earthquakes, its climate, its territorial divisions, its islands, its coasts, its geological construction, its natural productions, and kindred matters. According to the map of the British Admiralty, the island of Nias lies between 0° 32′ 42″ and 1° 32′ N. lat., and between 97° 0′ 30″ and 97° 58′ 42″ E. long. The nearest land is Sumatra, some 66 miles distant. In contour the island is decidedly mountainous, a succession of connected chains running south-eastwards from the north coast, and culminating in a peak some 1970 feet in altitude. Geologically it consists of compact calcareous and light-coloured argillaceous rocks, belonging to the Miocene and Pliocene eras. In many places there crop out calcareous masses of coralline origin, frequently at more than 300 feet above the sea. Nias is well watered by rivers, but none of them have a sufficiently steep decline to be either important or navigable. Moreover, the mouths of most of the smaller streams are blocked by sand-banks. The largest (the Modgeia), which reaches the sea on the south-east, is barely 100 yards wide and 16 feet deep at its mouth in the rainy season. The lower-lying level tracts of country are nearly all covered with long green herbage. In consequence of its geographical position, within less than two degrees of the equator, Nias is an island with a varying and humid climate. Rain falls almost continuously, more heavily in October, November, and December, and less copiously from May to August. The air is always laden with moisture in the morning and evening. The days are hot, though owing to the absence of large forests the whole island is freely exposed to the moderating sea-breezes. The nights are in comparison cold. During a period of 120 days the maximum temperature observed was

98°·6 Fahr., and the minimum 68°·18. During observations taken over 139 days from April to September 1886, rain fell on 88. Off the island of Nias there lie a great number of small coralline islands and islets, most of them covered with a dense vegetation, including coco-nut groves, rice-plantations, and patches of sweet potatoes. Between Nakko, one of the largest of these, in the west, and the principal island (Nias), Signor Modigliani discovered an islet, called Pulo Lavanda by the inhabitants of Nakko, which is not indicated on any map, neither on Rosenberg's nor on those of the Dutch and British Admiralties. In diameter it measures a little more than half-a-mile, and is about one and a half in circumference. Like all the neighbouring islands it is of coralline formation, and covered with coco palms. Not having either chronometer or sextant with him, he was unable to determine its precise position, but places it somewhere within the limits indicated by 0°·50′ and 0°·54′ N. lat., and 97°·23′ and 97°·29′ E. long. It probably owes its emergence to some recent seismical disturbance in Nias. For all these islands, Nias itself included, were at one time probably united to Sumatra, and still feel some of the effects of earthquake disturbance in the very active seats (Merapi, Talang, Berapi) of that large island.

Segama Expedition : British North Borneo.—Captain R. D. Beeston, commanding the British North Borneo Constabulary, left Sandakan in August of last year with the object of discovering the sources of the Segama, and of reporting on the auriferous prospects of the neighbouring country. His report is published in the *British North Borneo Herald* for 1st January 1888. Captain Beeston was successful in the main objects of his expedition ; he mapped out the route taken, and he made a careful exploration. The country at the head of the river Captain Beeston designates as a "payable field," rich in sport, and very healthy. It consists of steep, rocky hills rising sheer from the river ; to the westward are three distinct ranges of hills rising one above the other, doubtless being the watershed of other rivers crossing the "golden belt." Captain Beeston, in his report, does not precisely define the sources of the Segama ; but he says that the stream there is but a few feet wide, about 25 feet in its widest part, that the water is shallow, and that the stream runs round the base of a high sugar-loaf mountain about 2500 feet above the sea-level. He says that the surrounding country presents unquestionably a large field for mining enterprise, both in alluvial and reef mining, as it abounds in quartz reefs, the quartz being heavily impregnated with mineral.

The expedition had some remarkable successes in sport, and got the first "bag" of elephants that Europeans have made in that Territory. Captain Beeston says that from the Kinabatangan River to beyond the Dutch boundary wild elephants abound over all the British North Borneo Territory, the country about the Darvel Bay district, from Tanjong Unsang to Tuncu, being overrun with them ; while the country to the south of Silam—notably up the Diwata, Subahan, and Tingkaio rivers—is "haunted by these earth-shaking pachyderms." In the Segama River they are met with from the beginning of the true forest, above the limit of the *nipas*, right up to and beyond the head of the river—apparently in large numbers.

AMERICA.

Rainfall beyond the Mississippi.—General A. W. Greely, Chief Signal Officer of the United States, gave to the Washington Philosophical Society, at its regular meeting on February 18th, the partial results of a study he is now

engaged upon of the rainfall in the Trans-Mississippi region. He had before him a number of maps upon which had been charted the observations which were the basis of his study. He said that the idea that there is any part of the West that is absolutely rainless is now a banished myth. During the past ten years the number of stations for observation has been doubled, so that there are, in twelve States and Territories, nearly one hundred stations ; and the observations, if reduced to a single one, would cover a period of nearly five thousand years. The result of charting these observations has been to reduce very greatly the areas of small rainfall. The area in which the annual precipitation was supposed to be less than five inches has almost disappeared, and that in which the rainfall was put down at less than fifteen inches has been reduced by a quarter of a million of square miles since the Census Map of 1880 was made. General Greely discussed the question of what constitutes an arid region, and said that he did not agree with Major J. W. Powell, who placed the minimum amount of precipitation necessary for successful agriculture at twenty inches per annum. He said that millions of bushels of wheat are raised every year where the rainfall is less than twenty inches, and referred to the statistics of Dakota, where more than 2,600,000 bushels were raised in the two counties of Richland and Stutsman in 1885, and 1,500,000 in 1887, with an average rainfall of 13·7 to 15·1 inches. General Greely also mentioned the interesting fact that, while the rainfall increases as the rivers which flow directly into the Gulf of Mexico, or into the Pacific Ocean, are followed up from their mouths, it increases with the distance from the mouths of such as empty into other bodies of water, like the Colorado. General Greely's charts also prove that much of the rainfall in what has been known as the arid region, and where it was formerly supposed that the precipitation was five inches or less, was not reported. In some of these places the actual rainfall is as much as sixteen inches, and in one it is thirty-seven. This explains why water is found so abundantly in wells in some parts of southern California, where the annual rainfall has been reported as ten, twelve, and thirteen inches : the actual precipitation is twenty-four inches. General Greely said that he had caused to be placed upon the charts the maximum and the minimum rainfall of the various stations, not expecting that they would indicate anything but that the curves were almost as regular as those on the annual maps. He explained that the small average amount of rainfall formerly reported was due in part to the fact that so large a number of stations had been situated along the line of the Pacific Railroad, which, seeking low gradients, had been built through a section of country in which the precipitation was small. He spoke also of the prevalent opinion that the rainfall in the West is increasing, and said that he thinks this opinion to be correct. He closed with the remark that it was not fair to treat that country on the basis of seasonable rains, since the larger portion of the precipitation took place during different months in different sections of the region.

In the brief discussion which followed the address, Professor G. K. Gilbert said that it was not safe to fix any given amount of rainfall as the minimum necessary for successful agriculture, without qualifications. Very much depends upon the time when the rain falls, and the rapidity with which evaporation takes place. More rain is required in Arizona than in Dakota, and many unsuccessful agricultural experiments have been made in Utah, near Camp Douglas, where the annual precipitation is as much as eighteen inches.

Professor Fernow said that he had compared the amount of rainfall during the five months of vegetation, in Philadelphia, Buffalo, Dodge City, and North

Platte. It ranges from fifteen to seventeen inches, the largest amount of precipitation being at North Platte. There was no lack of rainfall at the eastern stations, but at North Platte it was impossible to raise a crop. He learned also from Utah that the amount of water needed to irrigate land there was less after two or three years than when it was first turned on.

Professor C. V. Riley spoke of the frequency and violence of the rainfall as modifying in an important degree its effect.—*Science*, 2d March 1888.

Greenland.—We are in possession of a considerable amount of information in regard to the progress made, or contemplated, in exploring the shores and interior of Greenland. Dr. H. Rink contributes to the *Journal* of the Royal Danish Geographical Society (vol. ix., No. 6) an important paper on the results of the most recent Danish investigations in regard to the interior and the origin of the floating icebergs. When in 1876 a systematic inquiry was instituted into the Physical Geography of Greenland, attention was chiefly given to the interior. It was questioned whether the whole were really covered with ice. The first thing to discover, therefore, was whether the margin of the inland ice was continuous, or whether it had any interruption or enclosed any valleys in the interior. This margin extends for some 800 geographical miles, 340 of which have been more or less thoroughly explored without finding any break in it. Those travellers who have attempted to cross the inland ice, after first overcoming the obstacles on the coast, have invariably found the ice to become smoother and smoother, and to give place to loose snow, from whence, as far as the eye could reach, a desolate but level expanse of snow stretched into the interior. The importance to geography and geology of exploring this region is due to the fact that Greenland is the only known accessible land on which observations can conveniently be made in regard to the origin of the floating icebergs, and the process of their detachment from the parent mass, and that, in the interior, data might be obtained in regard to glacial formation. The inland ice may be compared to an inundation. From the earliest times the land has been described as a snow-covered plateau. But in more recent times the question has repeatedly been asked: May there not be valleys filled with ice, the upper surface of which may still be on a plane? The solid land under the ice-cap is not necessarily flat. Should this supposition be found accurate, the analogy between the ice-conditions and an inundation would be found to be true. It must, however, be borne in mind that this plateau character of the ice obtains only at a considerable distance from the rugged coast and ice-margin, from whence the land gradually rises. The greatest height to which it has been observed to attain is some 6000 feet, though land 7000 feet above the sea-level has been recorded.

We referred some time ago (vol. iii. p. 58) to the attempt made by Lieutenant Peary, of the U.S. Navy, to cross the inland ice. From the report which he has contributed to the *Bulletin* of the American Geographical Society (vol. xix. No. 3) we gather some valuable information in regard to the ice-margin. He says:—"The coast line shows a great diversity of features, dependent upon the altitude, the season, and the elevation and configuration of the adjacent mountains. Wherever the ice projects down a valley in a long tongue or stream, the edges contract and shrink away from the warmer rocks on each side, leaving a deep cañon between, usually occupied by a glacier stream; and the upper surface, disintegrated by the reflected heat from the mountains above, and shattered by the daily change of temperature more perhaps than by the forward flow, presents a chaotic labyrinth of crevasses, gullies, and ragged pinnacles, increasing in magnitude in direct proportion to the length of the tongue and its approach to

the sea-level. Smaller tongues or teats, rounding down into shallow indentations in the crest of the mountain dam, are apt to have only their tips ragged and their upper surfaces covered with a net-work of narrow crevasses. Higher up, along the unbroken portions of the dam, where the rocks have a southern exposure or rise much above the ice, there is apt to be a deep cañon between the ice and the rocks; the ice-face is sometimes 60 feet high, pure, pale-green, and flinty. In another place the ice-face may be so striated and discoloured as to be a precise counterpart of the rock opposite, looking as if torn from it by some convulsion. The bottom of the cañon is almost invariably occupied by water. Where glacier streams find an exit through the crest of the dam, and there are no adjacent rocks higher than the ice to push it back with their reflected heat, the ice will reach down upon the rocks in a dome-like slope. Frequently drifts of fine hard snow extend like causeways from ice to rock, through the bases of which the littoral glacier streams tunnel a passage. Still further up, at the very crest of the dam, the ice lies smoothly against the rocks. As to the features of the interior beyond the coast-line, the surface of the 'ice-blink'[1] near the margin is a succession of rounded hummocks, steepest and highest on their landward sides, which are sometimes precipitous. Further in, these hummocks merge into long flat swells, which in turn decrease in height towards the interior, until at last a flat, gently rising plain is reached, which doubtless becomes ultimately level."

"In passing from the margin of the 'ice-blink,' to the remote interior, from one to five distinct zones may be noted, the number and width varying with the season, the latitude, and the elevation. In winter the entire surface is undoubtedly covered with a deep unbroken layer of fine dry snow. Late in the spring, the warmth of the sun at mid-day softens the surface of the snow along the low borders of the ice, and this freezes at night, forming a light crust. Gradually this crust extends up the interior, and with the advance of the season, the snow along the borders of the 'ice-blink' becomes saturated with water. A little later this zone of slush follows the zone of crust into the interior, the snow along the borders of the 'ice-blink' melts entirely, forming pools in the depressions, and streams, which cut deep gullies in the ice; water cavities form; old crevasses open, and new ones appear. This zone rapidly widens and extends into the interior in the footsteps of the others, and behind it the immediate border of the ice gets ragged and soiled, pebbles, boulders, and moraines crop out of its melting surface, and by the end of the Arctic summer it is eaten and shattered by the heat, and eroded by the streams, into impassable roughness."

Lieutenant Peary was, unhappily, unsuccessful in his attempt to cross from Disco Bay to Petermann's Mount (west to east). But, in our opinion, his mistake was in starting from the west coast, where there are several inhabited stations, to cross to the east coast, where there are none. The route across the inland ice must be from east to west. This Lieutenant Peary himself recognises, in the light of his acquired experience, when he says:—"The first step would be to cross from the base of Noursoak Peninsula, to the head of Francis Joseph Fjord, on the east coast, and return. Then, with the experience thus gained, start for Whale Sound, and, keeping sight of the land, follow the margin of the 'ice-blink' either into the north-east angle of Greenland or to its intersection with the east coast in a lower latitude, as the case may be. This route I believe to be the key to the solution of the Greenland problem."

Great interest will be felt in the expedition which Dr. Nansen, of Bergen, is

[1] Both the native and the Danish colonists almost invariably refer to the inland ice as the "ice-blink;" and Lieutenant Peary follows their example.

contemplating across the inland ice, and to which we briefly alluded in the January number of the Magazine. In reference to this expedition, Mr. W. E. Hoyle, of the Challenger Expedition Commission, who has been in correspondence with Dr. Nansen, supplies us with the following particulars :—

"Dr. Nansen proposes to sail from Iceland in the beginning of June, along with three or four hardy snow-shoe runners on board one of the Norwegian sealers, and to make up as close to the eastern shore of Greenland as possible, in about lat. 66° N. He will then start off with his party on the ice and walk towards the shore, taking a light boat in case it should be necessary to traverse open water before reaching the land. Previous experience with the sealer *Viking* in this region has convinced him of the feasibility of this plan of action. This part of the coast has not yet been explored, although in 1884 Captain Holm's expedition wintered in Angmagsalik, a little to the southward. After such investigations have been made on the shore as time will permit, the expedition will start inland, proceeding along the shore of one of the fjords until the interior ice is reached, and a course will then be steered for Christianshaab, in Disco Bay. The advantages which it is expected will be gained by aiming so far north instead of attempting to reach a point further south are, firstly, that a better track will probably be obtained for the snow-shoes ; and, secondly, that Disco Island, standing out from the land, will form, with its characteristic basaltic cliffs, a good landmark when seen from the interior. The distance to be traversed will be about 670 kilomètres (400 miles), and it is reckoned that from 12 to 20 miles can easily be accomplished in a day, so that the whole journey may be completed in a month. It is proposed to take provisions for twice that period, which will be carried on sledges, together with a tent, scientific apparatus, guns and ammunition, and other material, the weight of which will, of course, be reduced to the minimum possible."

Lieutenant Hovgaard, our Corresponding Member of Copenhagen, whose knowledge of the coast is very considerable, writes to us in reference to Dr. Nansen's expedition, that it is proposed to land the explorers a little to the north of Cape Dan ; but that "a ship might cruise along the shore for years without being able to effect a landing." Once landed, however, he thinks the travellers will have no insuperable difficulty in reaching the west coast ; as they could obtain no provisions on the east coast, they will, indeed, be compelled to reach one of the Danish colonies near Disco Island, or starve.

To return to Dr Rink's paper in the *Journal* of the Danish Geographical Society : it has often been asked whether the glacier-ice in Greenland increases or decreases ? When one considers that within the northern zone of Greenland all the icebergs are derived from its shores, one is met with the striking exception that there are still habitable spots on a coast from which large masses of ice, 1000 feet in thickness, are continually being detached. To this question Dr. Rink replies that the ice on this plane is found not in the immediate neighbourhood of the sea-shore, but is carried down by the rivers of the interior into the ice-fjords. According to the varying strength by which the remarkable movement of the ice from the far interior has thus been concentrated, the ice-fjords have been divided into four classes. On the west coast some nine ice-fjords have been assigned to the first rank, and a careful exploration of the interior ice in some of these fjords was one of the chief tasks of the Danish travellers. The result of their investigations may be summarised as follows :— The glaciers of Jacobshavn have a central progressive movement, at all seasons of the year, of over 50 feet a day. An arm of the glacier in Torsukatak fjord (70° 10′ N. lat.) moves at the rate of 20 to 30 feet daily. The Karajak glacier

in Umanak fjord moves from 22 to 38 feet daily, and the Itivdliarsuk glacier in the same fjord 21 to 46 feet daily. The breadth of these glacier arms were from 14,000 to 29,000 feet, and their thickness was estimated to be from 600 to 1000 feet. From these figures some conception may be obtained of the dimensions of the ice-barrier (if such a term may be applied to the coastal margin of the inland ice) which every year is protruded into the sea, and from which the icebergs are derived. Taking the diagonal as the breadth of these glaciers, and the distance traversed by them in the course of the year as their length, the dimensions of the glaciers we have referred to would be :—In Jacobshavn, $\frac{1}{2}$ mile broad, $\frac{1}{2}$ mile long, 800 to 1000 feet thick ; in Torsukatak fjord, 1 mile broad, $\frac{1}{4}$ to $\frac{1}{2}$ mile long, 600 to 800 feet thick ; the Karajak glacier, $\frac{3}{4}$ mile broad, $\frac{1}{3}$ to $\frac{1}{2}$ mile long, 800 to 1000 feet thick ; the Itivdliarsuk glacier, $\frac{1}{2}$ mile broad, $\frac{1}{4}$ to $\frac{1}{2}$ mile long, 600 to 800 feet thick.

The last Danish expedition, the partial results of which have only recently been made known, have added probably another ice-fjord of the first rank on the west coast and five ice-fjords on the east coast, together with a thorough investigation of one of the mightiest fjords on the west coast.

Many years of experience in regard to the separation of the ice, in the form of bergs, from the parent mass have been considered together. Like the ice-barrier of the Antarctic regions, the glaciers of Greenland are projected into the sea, the foremost portion of which is floated ; masses are disrupted according to the varying degrees of temperature ; and, according to recent observations, the edge of the glacier stretches sometimes a mile further into the sea than at other times. The glaciers issuing through the fjords from the inland ice make up a comparatively infinitesimal part of the 340 miles of the icy shores referred to. Numerous observations have been made at other spots, in order to ascertain the movement of the ice, especially on the low-lying shores. The special investigations of the so-called "Frederikshaabs Isblinks" showed that the ice from the interior is more or less at every spot impelled to the coast, but that the summer heat is sufficiently great to thaw the front and lower part of the surface, so that the secular movement of the ice, both forwards and backwards, is confined within certain known limits.

The figures we have mentioned in regard to the four ice-fjords show that each receives from the interior 84,000 to 180,000 millions cubic feet of ice per annum. For various reasons it may be presumed that a considerable amount of water in a fluid state flows through canals at the base, and along the course, of the advancing ice, and that it would require a surface of 1000 sq. miles to nourish a glacier of the first rank. A precise knowledge of the ice-fjords round the entire coast of Greenland, and of the meteorological conditions of this region, would, doubtless, enable one to roughly determine the water-partings and hydrographical basins of the country. Our present information is sufficient only to point to the probability that on the whole the flow is far greater to the west than to the east, but that in the southern, and narrower, part of Greenland, the reverse is the case. The highest land would probably be found in the neighbourhood of Franz-Josef fjord.

We are only now in a position to come across the lost traces of a glacial period. The inland ice has stretched to the west over the greater part of the coast-line, which is now free from ice. This combination of a present with a past ice-period must be instructive to geologists. The retreat of the ice-wall has usually been attributed to an increased mildness of the climate, but another cause may also be found in the fact already referred to, that the interior even now produces a surplus of ice, which is only hindered from stretching over the

land now free from ice through the retreat offered by the fjords. It is, however, quite possible that the beds of the ice-flow—that is, the paths conducting the ice to the fjords—have only been eroded in more recent times.

The same journal in which Dr. Rink's paper appears also contains an article by Herr. P. Eberlin, on *The Sound which in olden times probably ran through Greenland*. The Greenlanders themselves, according to Egede, believed that such a Sound once existed, though it would appear to be a physical impossibility. Herr Eberlin has therefore collected all the references that have been made to this subject by various writers, from which the conclusion is drawn that this supposition, like many other Greenland traditions, is based on a localisation of older memories, and may point to the way in which the east coast was populated.

AUSTRALASIA.

New Mecklenburg (New Ireland).—A French surgeon, Dr. Baudouin, has recently spent eight months on the island of New Mecklenburg (formerly New Ireland); and during the course of his stay he devoted his attention to the people, their customs, habits, and manner of living. This island lies immediately to the north of New Britain, between the Admiralty and Solomon groups. Long and narrow in shape, it is traversed from end to end by a chain of mountains, which rise steeply from the sea, their bare flanks clothed with dense tropical forests, though ground vegetation and herbage exist nowhere. The heavy rainfall, lasting from October to May, annually washes down any vegetable humus that might otherwise accumulate on the mountain sides. With his crisp hair and dusky skin, his cowardly manner, and his distended abdomen, the native of New Mecklenburg is far removed from the pure Polynesian type. In stature he rarely exceeds 5 ft. 6 in.; and the race as a whole is characterised in this respect by a remarkable uniformity. The facial angle is very appreciably more open than in the African Negro. The nose also is less flattened and the lips less tumid; and many individuals have their skin as light-tinted as the Malays. The eye is large, and the expression mobile and mistrustful. The physiognomy is on the whole intelligent. Although slender of form, they are well-proportioned, except in the calves of the legs, which are thin. The people live almost exclusively on the sea-shore, and are quite as much at home in the water as on land. Except on such occasions as feast days, official visits, and the performance of religious ceremonies, they go quite naked, except for a small apron of leaves. Through the septum of the nose they wear a piece of wood $1\frac{1}{2}$ in. long. The huts in which they dwell are low and small, generally of a beehive shape, with an aperture in the top for the escape of the smoke. In the matter of drink they are very temperate, their only beverages being water and the milk of the coco-nut. In place of indulging in any intoxicating drink, they chew a mixture of lime, areca nut, and betel leaves. On the whole, the New Mecklenburgers lead a thoroughly useless existence, spending most of their day lying among the fine sand that surrounds their island. As the fauna is extremely scarce, hunting is not pursued as an occupation; in fact, the inhabitants are driven to seek their living almost exclusively from the sea. Their chief articles of diet are crabs, molluscs, *Cyprinaceæ*, *Sepiadæ*, and hornbacks, all of which they devour raw. And in the same unprepared state they consume all the fish they kill, which they spear with marvellous dexterity. The only food they seem to cook is pork and human flesh. Of fruits they eat bananas, coco nuts, spondias, and the young shoots and fruit of the Bourbon and Pandanus palms. The only product of the soil which they—or rather the women only—cultivate, is the taro. The inhabitants of the different villages seem to follow different customs. The

chiefs are polygamous. In addition to their native tongue, which is described as sweet, musical, full of vowels, they have a sort of traders' jargon—a mixture of corrupt English, native, and Portuguese. As a race they are fond of singing and dancing. It is established beyond doubt that these people eat the prisoners they take in war, although they shroud in mystery all that relates to the practice. Dr. Baudouin is of opinion that a successful trade might be developed in copra, mother-of-pearl, and tripang, also that something might perhaps be made of the fragrant woods which grow in the forests.—*Bull. Soc. Géogr. Comm. du Havre*, July-August 1887.

ROUTES, RAILWAYS, CANALS, ETC.

The Portuguese Government have established (*L'Afrique* for February 1888) a **Telegraph Line from Quilimane** to the northern mouth of the Zambesi, and another from Quilimane to Mompea—distant about 60 kilomètres in the interior.

According to a telegram from Pietermaritzburg, Natal (13th March), the National Legislature has under its special consideration Bills for the extension of the railway system to the **Orange Free State and the Transvaal** borders, and the raising of a loan of £1,500,000 for that purpose. The Governor, in his speech, stated that the finances of the colony were in a highly satisfactory condition. There was a large surplus of revenue over expenditure last year, and a large surplus was expected this year. Sir Arthur Havelock further expressed approval of the proposals of the recent Cape Town Conference, and also notified that the Royal assent would be given conditionally to the union of the new Republic with the Transvaal.[1] Negotiations were proceeding on the subject between Sir Hercules Robinson and President Krüger.

The Atlantic-Mediterranean Canal.—The long discussed project of the "Canal des deux Mers" has recently been revived in France. French engineers and politicians are mostly inclined to advocate the canal starting in the west from Bordeaux, and following the left bank of the Garonne for some 80 kilomètres. It is proposed to construct a "pont canal," or aqueduct, at Castel-Sarrasin to carry the waters of the canal from the left to the right bank of the Garonne, which it would follow to Toulouse—the chief canal harbour. Between Toulouse and Narbonne it would require to cross the *Canal du Midi* twice. The fairway of the canal would be made 7½ mètres in depth, or 8½ mètres in the event of the French Minister of Marine requiring the canal to accommodate ironclads of the first class. Thirty-eight locks would be required. The cost of the construction of the canal is estimated at 650 million francs.

Railway from St. Paul de Loanda to Ambaca.—According to the *Revue Française*, a section of some 60 kilomètres of this railway was to have been opened in the commencement of this year. Ambaca is about 500 kilomètres from the coast, and is situated about 720 mètres above the sea-level. Leaving St. Paul the line runs along the coast and touches Boavista and Cocoaca. From thence it turns towards the north-east, joins the left bank of the Bengo, and follows the course of the river to lake Quilunda, about 60 kilomètres distant from the starting-point, the whole length of which has already been laid, The line is to be continued to beyond Ambaca : it is projected to reach Kassongé and to tap the commerce of Central Africa.—*L'Afrique*, Février 1888.

MISCELLANEOUS.

Mr. Rosset is about to undertake a systematic exploration of the **Maldive Islands**.

The great railway bridge over the **Amu-Daria** was opened for traffic on 6th January last.

[1] Were united by Treaty concluded at Pretoria, 14th September 1887.

The **River Thurso** has lately been gauged by Mr. D. Coghill, who found the rate of discharge to be 25,179 cubic feet per second.

The French protectorate has been proclaimed (*Deutsche Rundschau*, March 1888) over the **Wallis Islands** (between Fiji and Samoa).

A New American Geographical Society, under the title of the National Geographical Society, has been incorporated in the United States.

Mr. Joseph Thomson has left for Marocco, where he proposes to remain for some time, and to engage in the exploration of the Atlas Mountains.

The *Bulletin Officiel* of the **Congo Independent State** announces the creation of a loan of 150 millions of francs by a decree dated February 7, 1888.

The *Mouvement Géographique* of 12th February 1888 gives a summary of useful data collected by Lieutenant Wissman in the **basin of the Kassai**.

The *Mitteilungen* of the Vienna Geographical Society (No. 10, Band xxx.) contains a table showing the **Populations of German Towns** according to the census of 1st December 1885.

The *Mouvement Géographique* of 12th February 1888, presents an elaborate table showing the comparative **Area and Population** of the states of Europe, and of their colonies and protectorates.

The Congo Independent State has appointed two Belgian officers to the command of the expedition to Stanley Falls (*Scot. Geog. Mag.* vol. iv. p. 51), in place of Lieut. Van de Velde, who died of fever at Leopoldville.

The Netherlands Geographical Society has commissioned Lieutenant Meyjes and M. Wertheim to make a scientific exploration of the **Kei Islands**, which lie of Lieutenant to the south of the west coast of New Guinea.

The Russian **Pamir Expedition**, which has finished its important work, has made a report to the Petersburg Geographical Society. The expedition traversed some regions hitherto unvisited by Europeans.

The "German East African Plantation Society" has acquired by purchase the district of **Manyana**, which is contiguous to the district (or "plantation") of Kibueni, previously acquired.—*Deutsche Kolonialzeitung*, No. 8, 1888.

The next meeting of the **International Geological Congress** will be held in London from the 17th to the 22d of September next. During the week following the meeting there will be excursions to the districts of especial geological interest.

General Sir Andrew Clarke, according to a telegram from Singapore, 15th March, has been completely successful in the mission which he undertook to **Siam** with the object of arranging terms with the King on behalf of an English syndicate for the construction of a main line of **railway from Bangkok to Zimmé**.

The Portuguese Government have conceded to Spain for fifteen years a territory in the bay of Assab for the establishment of a coaling-station in the **Red Sea**. This territory is comprised between Cape Garibal and Cape Marcara; the roads offer anchorage for two or three large vessels. This concession does not affect the sovereignty of Italy over the ceded territory.—*L'Afrique*, Février 1888.

The *Deutsche Kolonialzeitung* (No. 8, 1888) announces that the tribes of Batangaland, who are as jealous of their trade monopoly as the Duallas, placed every obstacle in the way of Lieutenant Kund's expedition (*Scot. Geog. Mag.* vol. iv. p. 160), although not openly hostile. The expedition was in consequence forced to return, and the Governor of **Cameroons** despatched a gunboat to the Criby coast and captured the troublesome chiefs.

NEW BOOKS.

The Long White Mountain ; or, A Journey in Manchuria, with some Account of the History, People, Administration, and Religion of that Country. By H. E. M. James. Pp. xxiv. + 502. Map and Illustrations. London : Longmans and Co., 1888. *Price* 24*s.*

Mr. James's journey, in company with Mr. Younghusband and Mr. Fulford, through the "Three Provinces" of Manchuria, in 1886-1887, was full of all manner of interest—geographical, political, social, and commercial. It was well worth performing, and well worth describing. Perusal of his narrative in *The Long White Mountain* should be an inducement to other travellers to visit and explore a country about which there is still so much to be known that is deserving the pains and penalties of discovery, including the pains and penalties of the local plagues—to mention them in the order of what Mr. James considers their importance —of midges, gnats, filth, corrupt and greedy officials, and banditti. The "cream" of the story is that which relates to the ascent of the Changpai-Shan—the sacred "Long White Mountain"—mythical birthplace of the present Manchu dynasty of China, and centre of the legendary beliefs of the Manchus, Coreans, and other surrounding peoples—which gives its title to the book. Readers are probably not unfamiliar with this part of the experience of Mr. James and his companions, already described before the Royal Geographical Society, and are aware that, besides discovering the existence of a beautiful crater-lake on its summit—the "Dragon Prince's Pool," source of one of the principal branches of the Sungari River—he was able to reduce the height of the sacred White Mountain to the moderate elevation of about 8000 feet, and to remove from the maps the chain of snowy peaks 10,000 or 12,000 feet high, which had figured about this point of junction of the territories of China, Corea, and Russia. Before reaching the Chang-pai-Shan, Mr. James had traversed the beautiful and wild country between Moukden and the sources of the Yalu River, the ancient home of the small Manchu tribe, which, under Nurhachu and Tai Tsung, rose to the control of the Eastern World on the ruin of the dynasty of the Mings ; and his pages are full of historical and archæological information as well as other matter of interest. From the "Long White Mountain," his route led him into ground that is only now being reclaimed and occupied by the Chinese immigrants, who are, in a peaceful way, avenging themselves on the Manchurians by occupying their country and absorbing the aboriginal population. Kirin, the capital of the central province, now known as Ch'uan-Ch'ang, or the "Dockyard," has a growing population of from 75,000 to 100,000. It is indescribably filthy, but, besides being in telegraphic communication with the rest of the world, it has an arsenal and powder-mills, admirably erected and admirably managed by Chinese, without European assistance, and leaving no doubt of the earnestness with which the military strength of Manchuria is now looked to. The northern districts adjoining the Mongolian steppes and the Russian frontier on the Amour and in Primorsk Province, are still in a wild and unsettled state ; but the prospects are that in a few years, through the attention which both China and Russia are giving to this section of their mutual border, the remotest parts of Manchuria will make acquaintance with the only "resources of civilisation" to which the Celestials seem to take kindly—the manufacture of weapons of destruction. In his earlier chapters Mr. James gives a well-digested account of the people, history, administration, and religion of China and Manchuria ; and towards the close he describes the interesting

experiences of a journey through the peninsula of Kwantung (which still on some maps bears the absurd appellation of the "Regent's Sword," bestowed on it in the time of Lord Amherst's embassy), and his impressions of the fantastic mountain scenery and curious cave-temples which he visited, on his way to his final destination at Port Arthur, the headquarters of China's "Northern Fleet."

Life in Corea. By W. R. Carles, F.R.G.S., H.M. Vice-Consul at Shanghai; with Illustrations and Map. Pp. vii. and 317. Macmillan. *Price* 12*s.* 6*d.*

The author, armed with official introductions, made an extensive tour through the northern half of this little-known region. Starting from Soül, the capital, he travelled up the west side of the peninsula to Wi-ju, on the Chinese frontier, where, being refused permission to penetrate into Manchuria, he passed to the east, across a region where the general poverty, everywhere so marked a feature, is accentuated by the increased cold and elevation, and, journeying southward, crossed the peninsula again to Soül. He protests against the application of the term "peninsula" to a country which at its narrowest point is 200 miles across, but viewed in relation to the surrounding geography the term is at least as applicable as it is, *e.g.*, to Spain.

Corea owes its long-continued seclusion not merely to the energy with which it has opposed all intercourse with the outer world, but partly, like other countries similarly conditioned, to the mutual jealousies of its would-be visitors. Within the last few years, however, considerable concessions have been made, and besides a very few European traders, many Chinese and Japanese are settling within the permitted districts, and by their superior intelligence and energy are monopolising any trade that there is. The country, however, according to Mr. Carles, produces as yet very little. The people seem very lazy, their agriculture is of the poorest, and the soil, for want of terracing, or of forests, on the hill-sides, is frequently washed away by floods; the Government, too, appears to discourage the working of the mines, although copper, galena (worked for the silver), and gold, are found in paying quantities. But it may well be doubted how far we as yet understand the feelings or motives of either Government or people. The author met almost uniformly with civility, yet his presence was evidently not always welcome, and he often found reluctance to afford information. On the other hand, the people sometimes begged touchingly for advice how to mitigate their extreme poverty. The most valuable product of the country is the famous ginseng root, about which the author gives some information; and his short, but clear and often humorous notices of the everyday life of this remote people are full of interest and novelty. There is excellent pheasant and duck shooting, and tigers and panthers are numerous, and commit much havoc among the live stock. The illustrations, reproduced from paintings by a Corean artist, are of much interest, besides being in excellent drawing.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the Civilised World, for the year 1888. Edited by J. Scott Keltie, Librarian to the Royal Geographical Society. Twenty-fifth annual publication. Revised after official returns. London: Macmillan & Co., 1888. *Price* 10*s.* 6*d.*

The present edition of this excellent work of reference will maintain the reputation so justly acquired in previous years. It is at once clear, concise, comprehensive and accurate. Although considerable alterations and additions have been necessarily made to meet the political and economic changes in the world's history during 1887, the subject-matter has been so skilfully condensed

and arranged that the volume still keeps well within the limits of a handy book of reference. It extends to 988 pages.

It is not easy to say in what department the work most excels ; there is such a general average of excellence. It is, perhaps, least successful in the head of "Constitution and Government." Specially deserving of praise is the arrangement of matters under the head of "The German Empire." Each of the numerous federal States of this great monarchy has been dealt with in full detail, and nearly every possible information that could be desired in a book of reference respecting German affairs is to be found therein.

The following points occur to us for criticism :—

Under "Greece" it would rather appear that some of the statistical information regarding education, population, etc., is not quite brought down to date. As considerable changes have lately taken place in this rapidly developing country, it is of course very important that such details should be of the most recent date possible. It is not stated that the information afforded by the statistical departments of the Greek Government is incomplete.

Under "Spain" we notice that in the Table of Money the *duro* (equivalent of 5 *pesetas*) and the 2-*peseta* piece—coins which are in common circulation—are omitted, while the *escudo* (or $2\frac{1}{2}$-*peseta* piece) which is less frequently met with, is given. We should have expected also that, in the account of "Area and Population," some specific mention would have been made of the Catalans—a race which probably more than any other in Spain has contributed to the development of its commerce and has always been first in the field of colonial enterprise.

In the section of the book devoted to America we are glad to observe the fulness of information given respecting the South American republics. Accurate knowledge about these States is becoming every year more requisite, considering the attention that is being directed towards them as a field for emigration. Towards the Argentine Republic, in particular, the stream of emigration is increasing year by year. We may observe that the equivalents given in English money (actual values of the currencies) for the coins of some of the republics seem to be in several cases (*e.g.* the Peruvian dollar) considerably too high.

The information given about "Egypt" has, perhaps, been too much curtailed. More might have been said about the administration of Egyptian affairs, in view of the widespread interest which that country has awakened in Great Britain in recent years.

Among the list of representatives of foreign countries in Great Britain the names of the Consuls-General have been in a good many cases omitted. This information might, surely, be obtained without difficulty.

In concluding this notice we may say that not the least satisfactory feature of the book is the clear and accurate manner in which the index has been compiled.

A Treatise on Rivers and Canals, relating to the Control and Improvement of Rivers, and the Design, Construction, and Development of Canals. By Leveson Francis Vernon-Harcourt, M.A., Balliol College, Oxford ; Member of the Institution of Civil Engineers. Oxford : The Clarendon Press. Two vols. *Price* 21*s.*

This work has been before the public for some time, and, therefore, an exhaustive review is now unnecessary. The natural phenomena connected with rivers has, from the time of Herodotus and Polybius, possessed more or less interest for geographers : these far-seeing philosophers devoted considerable

attention to the work of the Nile, Danube, and other rivers, and their observations, even at the present day, are of value and interest. Lombardini, in the last century, gave accounts of the denuding action exercised upon their basins by several of the Italian streams, and speculated upon the growth of their deltas. But it was not until Sir Charles Lyell produced his great geological works that attention was thoroughly aroused to the vast importance of the subject, and, considering this great importance, it is wonderful how few and, generally, careless have been the observations since recorded. To one part of this subject—viz., the water discharge of rivers—the author has devoted considerable space, and very clearly and succinctly describes the best methods of ascertaining volumes of discharge. It almost appears a pity that examples of attained results are not added to this part of the work. As bearing upon the development of commerce, the remaining parts of the text have a slight reference to geography, but not sufficient to warrant our entering upon them, beyond mentioning that the same clear style, above alluded to, characterises the whole work, and lifts it beyond the level of a purely professional production. The illustrations are excellent, although, as is but proper in a work of the kind, effect has been sacrificed to clearness. The plan of dividing the treatise into two volumes, the first containing the text and the other the plates, is one to be commended, if for no other reason than that the reader is spared the annoyance and distraction of a large plate suddenly unfolding itself from among the pages. When it is said that this work is altogether admirable, we speak not from a hasty perusal, but from a past experience of its value. It may be heartily, and without hesitation, recommended to all interested in hydrography.

The Australian Handbook (incorporating New Zealand, Fiji, and New Guinea), and Shippers' and Importers' Directory for 1888. Maps, Plans, etc. London, Melbourne, and Sydney : Gordon & Gotch. *Price* 10*s.* 6*d.*

Australia is the only country in the world which has an annual gazetteer and atlas. The reputation of the Australian Handbook is already so well established as an indispensable work of reference to all engaged in colonial trade—shippers, importers, and any one requiring information about Australia and New Zealand—that we need not recapitulate its usefulness. The present volume for 1888—the nineteenth issue—besides undergoing the usual thorough revision, has been considerably extended.

Among the more important additions we specially note a "Hundred Years' History of New South Wales," with reference to the centenary of that colony. In Victoria and South Australia we have a detailed account of the important new irrigation schemes, and also a valuable geological and mineralogical description of the Northern Territory. A series of diagrams illustrating the rise and fall of Australian bank shares, wool, etc., on the London Stock Exchange, ought to be found useful and instructive. The only objection we have to the volume is its tendency to bulkiness, the maps and plans have far too many folds, and seem to occupy more paper than is actually necessary.

NEW ATLASES AND MAPS.

ATLASES.

APPLETON'S ATLAS OF THE UNITED STATES, consisting of General Maps of the United States and Territories, and a County Map of each of the States. 1888. *New York: D. Appleton & Co. Price* 6*s.* 6*d.*

This is a very handy and useful book, being, as it were, a fairly complete

compendium of the geography of the United States. Although the engraving of the maps is rather rough, yet they are clear and distinct. The letterpress which accompanies each map summarises the leading geographical features, and gives many useful statistics; but the absence of an index is a distinct want.

BERGHAUS' PHYSIKALISCHER ATLAS. Vierzehnte Lieferung. Inhalt: Nr. 15, Oceanien (Dr. H. Berghaus); Nr. 26, Westindien (Dr. H. Berghaus); Nr. 43, Aenderung der magnetischen Deklination (Dr. G. Neumayer).

Gotha: Justus Perthes. Price M. 3.

SYDOW-WAGNER'S METHODISCHER SCHUL-ATLAS. Entworfen, bearbeitet und herausgegeben von Hermann Wagner, 60 Haupt- und 50 Nebenkarten auf 44 Tafeln. *Gotha: Justus Perthes*, 1888. *Price M.* 8.

During the last few years there has been keen competition among German map publishers to produce the best school atlas, and the general result has shown a very great improvement in map-making. Last year there were several very good school atlases—so good that it shows considerable enterprise on the part of Messrs. Justus Perthes to bring out another. They have, however, aimed at producing an independent, high class atlas, without considering the expense—for eight marks is certainly a high price for a school book.

The atlas is specially designed to suit all text-books—junior and senior—for the purpose of serving the student through his geographical studies, from the elementary to the advanced lessons in geography. The intention is good; and in this way the student is likely to become thoroughly acquainted with his atlas. The prominence which is given to Physical, Astronomical, Mathematical, and Statistical Geography is the distinguishing feature of the work; some of the special maps are perfect specimens of cartography, both for clearness as well as for beauty of execution. If, however, we were to judge of the general accuracy of the work by the map of our own islands, we should be led to call it seriously into question.

MAPS.

EUROPE AND ASIA.

DER EUROPÄISCHE ORIENT im Masse 1 : 1,200,000, nach den neuesten Quellen. 1887. *Wien: K.K. Militär Geographischen Institute.*

This map is one of the finest publications of the Vienna Geographical Institute, and is in all respects a perfect specimen of cartography.

BRITISH NORTH BORNEO, compiled from the Admiralty Charts and the Explorations of Messrs F. X. Witti, W. B. Pryer, F. Hatton, H. J. Walker, and D. D. Daly. Scale 1 : 970,000.

Proceedings of the Royal Geographical Society, January 1888.

This is the best map of British North Borneo extant.

NEUSIBIRISCHEN INSELN, und des Jana-Landes. Zur Uebersicht der Reiserouten einer von Dr. Alexander Bunge und Baron Eduard Toll, 1885 und 1886. Mittlerer Massstab, 1 : 3,000,000.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 4. *Gotha: Justus Perthes.*

REGEN-VERHÄLTNISSE DES RUSSISCHEN REICHES. Nach H. Wild. Niederschläge in *mm.* Winter—Frühling—Sommer—Herbst—Jahr—Regentage im Jahr.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 6. *Gotha: Justus Perthes.*

JAPAN.—Dichtigkeit der Bevölkerung in Japan.

Yokohama: Mitt. der Deutschen Gesell. für Natur- und Völkerkunde Ostasiens in Tokio. October 1887.

AFRICA.

USEGUHA, Originalkarte von Joachim Graf Pfeil's Reiseroute durch Useguha. 1887. Massstab, 1 : 1,000,000.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 1. *Gotha: Justus Perthes.*

LAKE SHIRWA and Neighbourhood, by Rev. ALEX. HETHERWICK, M.A., Church of Scotland Mission, East Africa. Scale, 1 : 365,000.

Proceedings of the Royal Geographical Society, January 1888.

CUBANGO. Expedãico ao Cubango 1885-86. ARTHUR DE PAIVA. Escala, 1 : 1,000,000.

Lisboa: Boletim da Sociedade de Geographia. 7a Serie, No. 2, 1887.

SCIOA ED HARAR,—Carta originale del dott. VINCENZO RAGAZZI. Scala. 1 : 1,000,000. *Roma: Presso la Societa Geografica Italiana*, 1888.

MAROKKO. Karte des Westlichen Sûs-, Nûn und Tekĕna-Gebiets. Nach spanischen Quellen und eigenen Informationen zusammengestellt von M. QUEDENFELDT. Massstab, 1 : 1,000,000.

Berlin: Zeitschrift der Gesellschaft für Erdkunde, No. 131, 1887.

KASSALA und dem Setit.—JOSEPH MENGES' Reisen zwischen ——. Massstab, 1 : 1,000,000.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 5. *Gotha: Justus Perthes.*

CONGO. Karte der Karawanenrouten im Gebiete der Livingstonefälle des Unteren Congo. Von OSCAR BAUMANN. Massstab, 1 : 40,000.

Wien: Mitteilungen der K. K. Geographischen Gesellschaft, Band XXX., *No.* 10.

SOUDAN FRANÇAIS.—Reduction de la carte au échelle 1 : 750,000. Dressée, sous la direction du Commandant Valliere, par le Sous-Lieutenant PLAT. Echelle 1 : 1,250 000.

Paris: Bulletin de la Société de Géographie. 4e Trimestre, 1887.

ROYAUME DE CHOA et Pays Gallas, par A. AUBRY, Ingénieur des Mines, 1883-85. Echelle, 1 : 1,650,000.

Paris: Bulletin de la Société de Géographie. 4e Trimestre, 1887.

SOUTH AMERICA.

KOLONIE GRÃO PARA nebst angrenzenden Landesteilen und der Santa Christina Eisenbahn. Dr. H. LANGE. Massstab, 1 : 400,000.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 2. *Gotha: Justus Perthes.*

RIO DÔCE and its Tributaries, from a traverse Survey by W. I. STEAINS, 1885-6. Scale, 1 : 700,000.

Proceedings of the Royal Geographical Society, February 1888.

SIERRA NEVADA DE SANTA MARTA. Staat Magdalena, Colombia. Auf Grund der Karte von Simons und nach eigenen Aufnahmen gezeichnet von Dr. W. SIEVERS. 1888. Massstab, 1 : 500,000.

Berlin: Zeitschrift der Gesellschaft für Erdkunde, Nos. 133, 134, 1888.

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THE EXPLORATION OF THE GULF OF GUINEA.

By J. Y. Buchanan, F.R.S.

(*Continued from page* 200.)

The surface waters of the Gulf of Guinea are in many places richly stocked with small fishes of various species, which vary in size from half an inch in length and upwards. In many areas—*e.g.* off the river Congo and in the vicinity of Ascension—the ova of these creatures abound, and it is no uncommon occurrence to procure good gatherings of their eggs, showing the unhatched embryo fish in various stages of its development. Associated with these fish ova, and having perhaps a wider distribution, many crustacean ova occur.

The Radiolaria were found to be abundantly represented all through the Gulf of Guinea. The finest collections were made in the immediate vicinity of S. Thomé Island, and to the north-east of Ascension.

From their importance as a deposit-forming group, much attention was paid to the occurrence of the Foraminifera. Only a very few forms of these organisms were found to the north of Cape Palmas, and, as in the case of Radiolaria, the best specimens were found near S. Thomé and again near Ascension.

All along the west coast diatoms were found to occur; but there were particular localities where they were met with in enormous abundance, and almost to the exclusion of every other organism. Three "Diatom banks" of large dimensions were met with, besides several smaller ones. The first was encountered to the south-west of the mouth of the Niger. It was composed almost exclusively of frustules belonging to the genus *Ethmodiscus*. The density of the water was very low, showing the influence of the great river in the neighbourhood. The ship sailed for nearly 200 miles through this bank, and its vertical thickness was proved to be from 40 to 50 fathoms. A second no less important diatomaceous bank, and one differing entirely in constitution and extent from the former, was found between S. Thomé and the mainland. The chief genus forming this bank is the well-known cylindrical-shaped

Rhizosolenia. The third great ocean bank was met with about 100 miles north of Sierra Leone. Here great bands of blood-coloured water were found in the sea, and on examination they were found to be due to the presence of immense masses of the diatom *Meridion*. The green chlorophyll granules of this singular arc-like genus are masked by the presence of the peculiar colouring substance called *diatomin*, and hence results the blood-like appearance referred to. It is remarkable that, though the water at the surface had a colour so strongly red that the patches or fields of it could be seen several miles from the ship, the tow-net brought comparatively few specimens of the diatom from the surface, but when sunk for only a few minutes, to a depth of 10 fathoms, it came up glutted with a red mass of *Meridion*. If they had been present to the same extent on the surface the water must have had a colour comparable with that of fresh arterial blood.

The presence of diatoms in large masses was not found to exclude the occurrence, even in abundance, of Radiolaria and Foraminifera; near the Island of S. Thomé, and also near Ascension, rich gatherings of all three were obtained in the same locality. On the other hand, crustacean larvæ seemed to be crowded out by a great abundance of diatoms. It is a well-known fact, and it has been alluded to above, that many of the organisms inhabiting the upper layers of the ocean, go through a process of diurnal migration, by which they come to the surface as daylight disappears, and sink again as it appears. Gatherings with the tow-net at the surface are therefore always richer at night than during the day. This was found to be confirmed by the numerous experiments made in the *Buccaneer*. The creatures which abounded on the surface at night could, however, be readily obtained in daylight by fishing at a depth of from 15 to 30 fathoms. It is remarkable that in the course of this migration, of a few fathoms vertically, which they undertake in order to remain in a state of perpetual gloom, they pass in the twenty-four hours through climatic changes in their environment equivalent to a migration of some thousands of miles horizontally, at the surface. At night these organisms inhabit water having a temperature of from 80° to 85° F.; during day they retire into water having a temperature of 55° to 65° F. It is evident therefore that climate, in so far as temperature is concerned, has comparatively little influence on their distribution.

The ship arrived at Ascension on the 1st March, and received her mails on board. There was a north-westerly swell breaking on the shore, and "rollers" were anticipated. This swell visibly increased during the night, and at daybreak the "single-roller flag" was hoisted at the landing-place, indicating that landing was difficult, and at 10 A.M. the "double-roller flag" was hoisted to show that landing was impossible. During the whole of the 2d and 3d, communication with the shore was cut off, but the sight of the enormous rollers breaking on the black lava rocks, and even far out in the bay and close to what is considered safe anchorage, was worth coming far to see. The *Buccaneer* was anchored in ten fathoms of water, and when the larger rollers came in on her they gave forth an ominous "swishing" sound while they hurried her forward on their almost breaking crest. During the day the trade-wind blew fresh off shore, but at night it fell nearly calm. The ship, however, was always

kept stern out to sea by the backwash from the breakers, which produced a decided current seawards, and prevented the ship tailing in towards the shore when the wind dropped.

During the 2d and 3d, with Captain Thomson, I made a series of observations for determining the size and speed of the rollers. The method used for determining the wave-length was to measure by means of twine the distance between two floating objects which were simultaneously on the crest of two consecutive rollers. One of the objects was a mooring buoy known as the "Flora's buoy." The end of a reel of twine was attached to it, and the boat was pulled out in the direction whence the rollers were coming until the boat just topped one roller as the buoy topped the one before it. The boat was anchored in this position, and the height of the rollers taken by means of two hand lead lines made of twine. The depth of the water in the trough was taken by the one, and on the crest with the other, the difference giving the height of the roller. The time also required for the roller to run from the boat to the buoy was taken. When these observations were concluded a torpedo buoy was moored in the position of the boat to facilitate observations from the ship, and the boat pulled on board, and the various pieces of twine were measured. The general result of the observations, both in the boat and on board, was to show that the height of the highest rollers was twenty feet from trough to crest, and that of the lowest twelve feet. The length from crest to crest of medium rollers was 625 feet, and they traversed this distance in sixteen seconds, giving a speed of 23·4 nautical miles per hour. The largest rollers travelled at exactly the same speed, as measured by the time they took from passing the ship to break on the beach; their wave-length was 770 feet, which they traversed in twenty seconds. Measurements at sea of the same class of waves gave almost exactly the same speed of twenty-three to twenty-five miles per hour. On the 4th of March the *Buccaneer* left Ascension, and after doing some work in the vicinity of the Equatorial Ridge she arrived again at Conakry on 15th March. She left Conakry on the 18th, and proceeded homewards with all speed, touching at Porto Praia, in the Cape Verde Islands, for provisions, and at Teneriffe for coal. She arrived in the Thames on 6th April. During the whole cruise the health of the crew was excellent. There were no accidents, and there was an almost complete immunity from fever, the great curse of the West Coast of Africa.

The nature of the material and data with which the Buccaneer Expedition will be able to enrich science may thus be summarised:—

The number and closeness of the soundings reveal all the topographical details of the ground traversed. From nearly all these soundings samples of the mud have been obtained which indicate its geological or stratigraphical character. The waters have been explored physically, and their condition as regards temperature and density has been determined in considerable detail. Much information with regard to the movement of the waters has also been obtained, and the character of the life inhabiting them has been extensively explored. The working up of this material will necessarily take some time. Meanwhile we may hope that the intelligent example of the Silvertown Company will be followed by others, and that its public spirit may meet with an abundant reward.

EXPLORATION OF THE GULF OF GUINEA.

APPENDIX.

TABLE I.—*List of Soundings taken on board the S.S. "Buccaneer,"* 1886.

Date 1885, 1886.	Profile.	No. of Sounding.	Position. Lat.	Position. Long.	Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
					D	T	S	t	t – T	D – 250 = d
			° ′	° ′		°		°	°	
29 Dec.		1	13 48 N	19 18 W	2322					
1 Jan.		2	7 54	17 25	2623	..	1·02609			
2 ,,		3	7 1	15 54	2594	...	1·02589			
2 ,,		3 AT	7 1	15 58	2584	36·06	1·02581			
2 ,,	A	4	7 33	15 18	2406					
3 ,,	,,	5	7 38	14 59	2247					
3 ,,	,,	6	7 41	14 51	2181					
3 ,,	,,	7 T	7 44	14 41	1991	36·51	1·02589			
3 ,,	,,	8 T	7 45	14 35	1911	36·51	1·02573			
3 ,,	,,	9 T	7 46	14 31	1764	36·8	1·02583			
3 ,,	,,	10 T	7 47·1	14 26·8	1590	37·06				
3 ,,	,,	11 T	7 47·9	14 23·6	1369	37·46	1·02584			
3 ,,	,,	12 T	7 48·5	14 21·5	1226	37·78	1·02573			
3 ,,	,,	13 T	7 48·2	14 19	922	38·41	1·02573			
3 ,,	,,	14 T	7 48	14 16·4	706	39·67	1·02554			
3 ,,	,,	15	7 47·9	14 13·6	656					
3 ,,	,,	16	7 47·6	14 11	376					
3 ,,	,,	17	7 47·4	14 8·4	197					
3 ,,	,,	18	7 47·3	14 5·7	52					
4 ,,		19	7 18	13 28	157					
4 ,,		20	7 19	13 27	52					
4 ,,	B	21	7 20	13 26	45					
4 ,,	,,	22	7 18	13 26	192					
4 ,,	,,	23 T	7 17	13 26	357	43·69				
4 ,,	,,	24 T	7 14	13 26	609	40·12	1·02582			
4 ,,	,,	25 T	7 12	13 27	698	39·85	1·02582			
4 ,,	,,	26 T	7 10	13 27	890	38·68	1·02582			
4 ,,	,,	27 T	7 8	13 27	1091	38·41				
4 ,,	,,	27 A	7 8	13 23	1091					
4 ,,	,,	28	7 1	13 25	1817					
5 ,,		29	7 2	13 24	1690	...	1·02582			
5 ,,		30	6 49	13 33	2107	...	1·02564			
5 ,,		31 T	6 28	13 46	2376	36·24	1·02582			
5 ,,		32 T	5 48	14 20	2596	36·15	1·02574			
6 ,,	C	33 T	6 34	12 39	1824	36·51	1·02571	36·98	0·47	1574
6 ,,	,,	34 T	6 36	12 38	1798	36·60	1·02575	36·98	0·38	1548
6 ,,	,,	35 T	6 38	12 37	1773	36·60	1·02571	37·07	0·47	1523
6 ,,	,,	36 T	6 47	12 33	1604	36·78	1·02565	37·49	0·71	1354
6 ,,	,,	37 T	6 48·5	12 32	1510	37·24	1·02575	37·81	0·57	1260
6 ,,	,,	38 T	6 51	12 30	1417	37·37	1·02577	37·91	0·54	1167
6 ,,	,,	39 T	6 53·5	12 28.5	1317	37·6	1·02577	38 09	0·49	1067
6 ,,	,,	40 T	6 56	12 27	1026	38 18	1·02567	39·32	1·14	776
6 ,,	,,	41 T	6 58·5	12 25	833	38·77	1·02590	39·92	1·15	583
6 ,,	,,	42 T	7 1	12 23·5	658	39·72	1·02590	42·25	2·53	408
6 ,,	,,	43	7 3	12 22	160					
7 ,,		44	6 49	12 10	228	...	1·02527			
7 ,,		45	6 46	12 11	678	...	1·02586			
7 ,,		46	6 35·5	11 56·5	819					
7 ,,		47	6 31·5	11 39	539	...	1·02572			
7 ,,		48	6 19·5	11 27	757					

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t − T	D − 250 = d
			° ′	° ′		°		°	°	
7 Jan.		49	6 5 N	11 8 W	572					
7 ,,		50	6 9	10 55	45					
7 ,,	D	51	6 8	10 55	68					
7 ,,	,,	52	6 7	10 55	199					
7 ,,	,,	53	6 6	10 55·5	256					
7 ,,	,,	54	6 45	10 57·5	392					
7 ,,	,,	55	6 3	10 58	442					
7 ,,	,,	56	6 1	11 0	560					
7 ,,	,,	57	5 58·5	11 2·5	661					
7 ,,	,,	58	5 56·5	11 4·5	782					
7 ,,	,,	59	5 52·5	11 8	1103					
7&8 ,,		60	5 37·5	10 50	1215					
8 ,,		61	5 26·5	10 32	1180					
8 ,,		62	5 15	10 13	892					
8 ,,		63	5 3	9 56	605					
8 ,,		64	4 58	9 47·5	532					
8 ,,		65	4 48	9 43	600					
8 ,,		66	4 28·2	9 32·9	695					
8 ,,	E	67	4 21·5	9 8·3	556					
8 ,,	,,	68	4 23·4	9 6·3	366					
8 ,,	,,	69	4 26	9 4·4	264					
8 ,,	,,	70	4 28	9 2·4	188					
8 ,,	,,	71	4 30·1	9 0·4	102					
8 ,,		72	4 16·7	9 8·1	667					
9 ,,		73	4 7·5	9 13·0	1180					
9 ,,		74	4 7·6	8 51·6	1197					
9 ,,		75	4 13·7	8 31·4	1318					
9 ,,		76 T	4 6·9	8 10·4	703	39·54	1·02575			
9 ,,		77 T	4 11·2	8 1·1	298	44·1	1·02575			
9 ,,		78	4 18·8	7 53·8	34					
9 ,,	F	79	4 7·7	7 42·5	357					
9 ,,	,,	80	3 57·2	7 42·8	1567	36·83	1·02574	37·45	0·62	1317
9 ,,	,,	81	3 46·8	7 42·9	2010	36·47	1·02581			
10 ,,	,,	82 T	3 0·8	7 43·0	2546	36·47	1·02580	36·54	0·07	2296
10 ,,		83 T	3 59·4	7 30·3	952	38·41	1·02583	39·32	0·91	702
10 ,,		84	4 4·3	7 12·4	1481					
11 ,,		85	4 17·3	6 59·3	1054					
11 ,,		86	4 24·5	6 41·9	749					
11 ,,		87	4 32·1	6 24·4	562					
11 ,,	G	88	4 39·7	6 7·1	61	...	1·02602			
11 ,,	,,	89	4 37·7	6 6.5	234	...	1·02572			
11 ,,	,,	90 T	4 35·6	6 6·0	611	39·63	1·02575	42·11	0·48	361
11 ,,	,,	91	4 36·1	6 6·7	457					
11 ,,	,,	92 T	4 33·2	6 5·5	944	38·55	...	39·32	0·77	694
11 ,,	,,	93 T	4 31·6	6 4·4	1123	38·09	1·02582	38·59	0·50	873
11 ,,	,,	94 T	4 27·3	6 1·9	1327	37·37	1·02575	38·09	0·72	1077
11 ,,	,,	95 T	4 22·9	5 59·5	1513	37·06	1·02575	37·91	0·85	1263
11 ,,	,,	96 T	4 14·2	5 54·8	1643	36·87	1·02565	37·13	0·26	1393
11 ,,	,,	97 T	4 5·6	5 49·9	1817	36·51	1·02582	36·94	0·43	1567
12 ,,		98	4 43·8	5 37·9	792					
12 ,,		99	4 46·3	5 16·9	829					
12 ,,		100	4 49	4 57	909					
12 ,,		101	4 51·3	4 36·4	1006					
12 ,,		102	4 53	4 21	961					
12 ,,		103	5 2	4 8	284					
12 ,,		104	5 3	4 6	153					

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t−T	D−250=d
						°			°	
12 Jan.		105	5 14·5N	3 57·0 W	87					
12 ,,		106	5 14·5	3 57·3	76					
12 ,,		107	5 14·0	3 57·5	33					
12 ,,		108	5 12·0	3 57·5	50					
12 ,,		109	5 12·0	3 57·2	74					
12 ,,		110	5 12·0	3 56·7	215					
12 ,,		111	5 12·0	3 56·2	47					
12 ,,		112	5 10·0	3 56·2	88					
12 ,,		113	5 10·0	3 56·7	233					
12 ,,		114	5 10·0	3 57·2	133					
12 ,,		115	5 10	3 57·7	58					
12 ,,		116	5 10	3 59·7	48					
12 ,,		117	5 8	3 59·7	57					
12 ,,		118	5 8	3 58·7	59					
12 ,,		119	5 8	3 57·7	104					
12 ,,		120	5 8	3 56·7	327					
12 ,,		121	5 8	3 55·7	49					
12 ,,		122	5 6	3 55·7	47					
12 ,,		123	5 5·9	3 56·7	185					
12 ,,		124	5 5·8	3 57·7	452					
12 ,,		125	5 5·7	3 58·7	299					
12 ,,		126	5 5·6	4 0·7	66					
13 ,,		127	4 55·6	3 57·0	677					
13 ,,	K	128 T	3 58·0	3 42·0	1886	...	1·02582	36·81		
13 ,,	,,	128 AT	3 58·0	3 42·0	1886	36·48	1·02589	36·71	0·23	1636
13 ,,	,,	129 T	4 7·6	3 40·7	1794	36·60	1·02578	36·94	0·34	1544
13 ,,	,,	130 T	4 27·4	3 37·5	1234	37·82	1·02586	38·40	0·58	984
13 ,,	,,	131 T	4 32·1	3 36·5	1093	38·23	1·02579	38·74	0·51	843
13 ,,	,,	132	4 37·0	3 35·5	916					
13 ,,		133	4 34·4	3 14·9	898					
14 ,,		134	4 31·9	2 55·2	833					
14 ,,		135	4 26·4	2 35·0	579					
14 ,,		136	4 18·0	2 16·5	533					
14 ,,		137	4 21·3	2 1·3	223					
14 ,,		138	4 24·7	1 44·9	43					
14 ,,		139	4 28·6	1 28·4	36	...	1·02578			
14 ,,		140	4 32·7	1 12·5	30					
14 ,,	L	141	4 19·1	1 4·9	434					
14 ,,	,,	142	4 17·3	1 3·4	1083	...	1·02551			
14 ,,	,,	143	4 15·7	1 2·0	1727	...	1·02579			
14 ,,	,,	144	4 14·3	0 59·6	1973	...	1·02569			
15 ,,	M	145	5 15·5	0 13·0 E	1431	...	1·02563			
15 ,,	,,	146	5 17·6	0 13·2	1282	...	1·02562			
15 ,,	,,	147	5 22·3	0 11·6	868	...	1·02575			
15 ,,	,,	148	5 26·5	0 9·9	362	...	1·02550			
15 ,,	,,	149	5 28·4	0 9·6	107					
16 ,,	N	150	5 22·4	0 1·5 W	35					
16 ,,	,,	151	5 20·3	0 0·7 E	166					
16 ,,	,,	152	5 18·8	0 2·5	565					
16 ,,	,,	153	5 17·4	0 4·8	1270					
17 ,,	,,	154	5 16·1	0 7·4	1041					
17 ,,	,,	155	5 14·7	0 9·8	1311	...	1·02578			
17 ,,	,,	156	5 13·3	0 12·2	1488	...	1·02579			
17 ,,		157	5 18·8	0 21·8	1338					
17 ,,		158	5 24·1	0 31·3	990					
17 ,,		159	5 29·5	0 40·5	586					

Date. 1886.	Profile	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t − T	D − 250 = d
			° ′	° ′		°		°	°	
17 Jan.		160	5 29·8 N	0 51·1 E	555	...	1·02551			
17 ,,		161	5 30·1	1 1·7	944	...	1·02569			
17 ,,	P	162	5 35·5	1 11·1	1132					
17 ,,	,,	163	5 37·5	1 9·3	999	...	1·02571			
17 ,,	,,	164	5 39·6	1 7·4	847	...	1·02578			
17 ,,	,,	165	5 41·8	1 5·3	635	...	1·02564			
17 ,,	,,	166	5 42·9	1 3·2	366	...	1·02558			
17 ,,		167	5 46·0	1 1·0	18	...	1·02598			
17 ,,		168	5 45·6	1 8·3	840					
17 ,,		169	5 42·2	1 17·0	1145	...	1·02578			
17 ,,		170	5 48·0	1 23·4	1043	...	1·02581			
17 ,,		171	5 43·1	1 32·3	1328	...	1·02578			
18 ,,		172	5 49·8	1 38·6	1238	...	1·02568			
18 ,,		173	5 46·7	1 47·2	1404	...	1·02598			
18 ,,		174	5 52·5	1 53·6	1081					
18 ,,		175	5 49·1	2 2·5	1245	...	1·02570			
18 ,,	R	176	5 54·8	2 8·9	1105	...	1·02570			
18 ,,	,,	177	5 59·0	2 9·8	651					
18 ,,	,,	178	6 0·6	2 10·2	543					
18 ,,	,,	179	6 2·2	2 10·5	449					
18 ,,	,,	180	6 4·3	2 11·0	168					
18 ,,	S	181 T	6 5·0	2 45·0	418	41·98	1·02561			
18 ,,	,,	182 T	6 3·3	2 46·0	591	39·40	1·02580	43·35	3·95	341
18 ,,	,,	183 T	6 1·4	2 46·8	761	39·09	1·02571	39·87	0·78	511
18 ,,	,,	184 T	5 58·2	2 47·7	1084	38·27	1·02569	38·96	0·69	834
19 ,,	,,	185	5 49·8	2 52·2	1424					
19 ,,	,,	186	5 41·1	2 56·3	1625					
19 ,,		187	5 32·5	3 0·5	1691					
19 ,,		188 T	5 15·4	3 10·0	1783	36·60	1·02560	37·13	05·3	1533
19 ,,		189 T	4 46·6	3 13·4	1607	...	...	37·45	...	1357
19 ,,		190	4 58·1	3 29·3	1547	...	1·02580			
19 ,,		191	5 9·6	3 45·4	1332	...	1·02577			
20 ,,		192	4 35·4	3 43·2	1489					
20 ,,		193 T	4 12·7	3 57·5	1460	37·08	1·02562			
20 ,,		194 T	3 55·3	4 7·3	1391	37·22				
20 ,,		195	3 22·5	4 11·8	2040	...	1·02575			
20 ,,		196	3 36·6	4 28·1	1916	...	1·02563			
21 ,,		197	3 50·6	4 44·3	1362					
21 ,,		198	3 25·4	4 39·1	1858					
21 ,,		199	3 11·9	4 50·7	1878	...	1·02559			
21 ,,		200	2 52·5	5 7·4	1850	...	1·02568			
21 ,,		201 T	2 20·2	5 7·8	1986	36·58	1·02573			
21 ,,		202 T	2 34·9	5 22·2	1819	36·62	1·02573			
22 ,,		203	2 49·3	5 36·8	1484	...	1·02566			
22 ,,		204	2 16·3	5 38·2	1841	...	1·02577			
22 ,,		205 T	1 55·5	5 55·5	1943	36·54	1·02560	36·90	0·36	1693
22 ,,		206	1 33·4	5 53·4	1999	...	1·02545			
22 ,,		207	1 18·8	6 0·9	1899	...	1·02575			
23 ,,		208	1 4·1	6 8·4	1872	...	1·02570			
23 ,,		209	0 57·2	6 11·3	1838	...	1·02561			
23 ,,		210 T	0 50·0	6 14·6	1841	36·63	1·02568	37·03	0·40	1591
23 ,,		211 T	0 46·6	6 22·0	1787	36·71	1·02533	37·08	0·37	1537
23 ,,		212 T	0 38·6	6 25·8	1738	36·71	1·02558	37·21	0·50	1488
23 ,,		213 T	0 34·0	6 30·4	1627	36·62	1·02531	37·51	0·89	1377
23 ,,		214 T	0 32·7	6 31·6	1613	36·85	1·02520	37·64	0·79	1363
23 ,,		215 T	0 28·7	6 35·2	1254	37·86	1·02544	38·55	0·69	1004

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t−T	D−250=d
23 Jan.		216	0 26·3N	6 37·0 E	864	...	1·02566	°	°	
23 ,,		217	0 25·5	6 37·1	608	...	1·02532			
23 ,,		218	0 25·1	6 36·6	339					
25 ,,	X	219	0 25·3	6 38·7	26					
25 ,,	,,	220	0 26·1	6 38·7	201					
25 ,,	,,	221	0 25·7	6 38·7	110					
25 ,,	,,	222	0 26·5	6 38·7	458					
25 ,,	,,	223	0 27·4	6 38·8	780					
25 ,,		224	0 27·4	6 37·8	793					
25 ,,		225	0 27·4	6 36·9	835					
25 ,,		226	0 28·9	6 49·8	1554					
25 ,,		227	0 40·6	6 49·9	1693	...	1·02563			
26 ,,		228	0 45·5	6 59·1	1700	...	1·02544			
26 ,,		229	0 50·4	7 8·4	1586	...	1·02522			
26 ,,		230	1 1·8	7 8·5	1272					
26 ,,		231 T	1 13·1	7 8·7	930	38·86	1·02544	39·55	0·69	680
26 ,,		232 T	1 11·5	7 11·8	166	51·64				
26 ,,		233 T	1 9·6	7 15·3	134	57·21				
26 ,,		234 T	1 7·3	7 20·0	787	39·18	...	39·59	0·41	537
26 ,,		235 T	1 5·0	7 24·4	1174	37·95	1·02533	38·81	0·86	924
26 ,,		236	1 16·0	7 24·8	784	...	1·02559			
26 ,,		237	1 21·1	7 34·8	1073	...	1·02573			
26 ,,	Ψ	238	1 37·3	7 30·2	117					
26 ,,	,,	239	1 37·3	7 31·0	561					
26 ,,	,,	240	1 37·4	7 30·5	309					
26 ,,	,,	241	1 37·3	7 31·3	599					
26 ,,	,,	242	1 36·9	7 32·4	887					
26 ,,	,,	243	1 36·2	7 33.7	1092	...	1·02550			
26 ,,		244	1 29·0	7 33·8	1226					
28 ,,		245	0 23·0	9 6·0	27					
28 ,,		246	0 22·3	8 57·4	41					
28 ,,		247	0 22·3	8 55·6	48					
28 ,,		248	0 22·3	8 53·9	58					
28 ,,	T	249	0 22·3	8 52·2	65					
28 ,,	,,	250	0 22·3	8 50·4	165					
28 ,,	,,	251	0 22·3	8 49·8	214	...	1·02495			
28 ,,	,,	252	0 22·5	8 48·5	237	...	1·02526			
28 ,,	,,	253	0 22·8	8 47·5	298	...	1·02529			
28 ,,	,,	254	0 22·8	8 41·5	465	...	1·02508			
28 ,,	,,	255	0 22·8	8 33·2	660	...	1·02465			
29 ,,	,,	256	0 22·8	8 25·0	825	...	1·02498			
29 ,,	,,	257	0 22·8	8 16·7	1096	...	1·02498			
29 ,,	,,	258	0 22·4	7 59·8	1367	...	1·02552			
29 ,,	,,	259 T	0 22·1	7 42·9	1532	36·99	1·02519	37·68	0·69	1282
29 ,,		260 T	0 21·1	7 33·0	1564	...	1·02502	37·34	...	1314
29 ,,		261 T	0 22·5	7 22·3	1602	36·81	1·02525	37·38	0·57	1352
29 ,,		262	0 23·7	7 11·8	1612	...	1·02522			
29 ,,		263	0 22·8	7 1·6	1619	...	1·02501			
29 ,,		264	0 21·9	6 51·8	1307	...	1·02525			
30 ,,	Y	265	0 21·1	6 46·5	391					
30 ,,	,,	266	0 20·1	6 45·6	150					
30 ,,	,,	267	0 20·2	6 47·7	737					
30 ,,	,,	268	0 20·3	6 48·8	933					
30 ,,	,,	269	0 20·4	6 52·2	1256	...	1·02506			
30		270	0 24·9	6 52·2	1386	...	1·02563			
30 ,,		271 T	0 26·8	6 51·2	1516	36·90	1·02532	37·60	0·70	1266

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long. E.	D	T	S	t	t–T	D–250=d
30 Jan.	Z	272 T	0° 25′7 N	6° 47′4 E	1384	37°13	1·02554	38°07	0°94	1134
30 ,,	,,	273	0 24·2	6 46·2	957	...	1·02522			
30 ,,	,,	274	0 23·3	6 45·6	519	...	1·02524			
30 ,,	,,	275	0 22·3	6 44·7	18					
2 Feb.	Φ	276	0 17·9	6 46·8	201					
2 ,,	,,	277	0 17·7	6 47·4	557					
2 ,,	,,	278	0 17·5	6 48·6	889					
2 ,,	,,	279 T	0 17·4	6 49·8	1017	38·37	1·02546	39·25	0·88	767
2 ,,	,,	280 T	0 17·0	6 52·7	1282	37·35	1·02532	38·20	0·85	1032
2 ,,		281 T	0 7·6	6 59·2	1601	36·85	1·02499	37·38	0·53	1351
2 ,,		282 T	0 1·2 S	7 5·9	1622	36·80	1·02530	37·34	0·54	1372
2 ,,		283 T	0 10·1	7 12·6	1580	36·90	1·02556	37·47	0·57	1330
2 ,,		284	0 19·2	7 19·0	1542	...	1·02541			
2 ,,		285	0 32·5	7 28·2	1461	...	1·02559			
3 ,,		286	0 45·8	7 37·4	1341					
3 ,,		287	0 59·1	7 46·6	1231	...	1·02562			
3 ,,	V	288	1 12·4	7 55·8	1138	...	1·02567			
3 ,,	,,	289 T	1 22·2	7 45·0	1396	37·30	1·02577	38·07	0·77	1146
3 ,,	,,	290 T	1 6·2	8 10·4	757	39·32	1·02521	39·98	0·66	507
3 ,,	,,	291 T	1 1·2	8 19·7	342	42·03	...	59·54		
3 ,,	,,	291 A	1 1·2	8 19·7	362					
3 ,,		291 B	1 1·2	8 19·7	346	...	1·02538			
3 ,,		292	1 30·2	8 8·6	997	...	1·02585			
4 ,,		293	1 47·7	8 21·3	1008					
4 ,,		294	2 4·8	8 33·6	805					
4 ,,		295 T	2 21·9	8 45·8	424	40·20	1·02583	42·24	2·04	324 } 100 fathoms from bot'm.
4 ,,		296 T	2 39·0	8 58·0	249	48·98	...	55·54	...	149 }
4 ,,		296 A	2 39·0	8 58·0	239	..	1·02611			
4 ,,		297 T	2 47·3	8 46·0	658	39·46	1·02596	40·02	0·57	408
4 ,,		298 T	2 56·9	8 54·0	592	39·51	1·02593	39·94	0·43	492
4 ,,		299	3 11·9	9 4·9	684	...	1·02593			~~
4 ,,		300	3 26·8	9 15·9	887	...	1·02579			100 fms. fm b't'm
5 ,,		301	3 42·8	9 26·8	1018	...	1·02587			100 fms. fm b't'm
5 ,,		302	3 56·7	9 37·7	1135	...	1·02577			~~
5 ,,		303 T	4 11·1	9 49·3	1326	37·49	1·02583	37·73	0·24	1226
5 ,,		304 T	4 26·7	10 1·8	1534	37·03	1·02577	37·60	0·57	1284
5 ,,		305	4 40·0	10 25·2	1365	...	1·02567			
5 ,,		306	4 55·9	10 47·3	1045	...	1·02569			
6 ,,		307	5 21·1	10 58·8	887	...	1·02543			
6 ,,		308	5 46·3	11 10·4	498	...	1·02564			
6 ,,		309	5 54·5	11 14·0	981					
6 ,,		310	5 54·3	11 22·0	489	...	1·02572			
6 ,,		311	5 54·0	11 33·0	102	...	1·02595			
6 ,,		312	5 55·1	11 42·0	50					
6 ,,		313	5 55·8	11 50·3	35	...	1·02604			
6 ,,		314	5 56·7	11 58·1	24	...	1·02575			
6 ,,		315	5 56·9	12 2·2	15					
6 ,,		316	6 1·3	12 12·4	8					
6 ,,		317	6 1·7	12 12·5	10					
6 ,,		318	6 2·5	12 12·5	272					
6 ,,		319	6 3·0	12 12·5	333					
6 ,,		320	6 3·5	12 12·5	257					
6 ,,		321	6 4·1	12 12·6	140					
6 ,,		322	6 4·7	12 12·6	13					
6 ,,		323	6 4·1	12 15·5	52					
7 ,,		324	6 3·4	12 17·2	49					

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom.	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t−T	D−250=d
			° ′	° ′		°		°	°	
7 Feb.		325	6 2·1 S	12 17·2 E	228					
7 ,,		326	6 2·6	12 17·2	241	...	1·02454			
7 ,,		327	6 3·0	12 17·2	242	...	1·02465			
7 ,,		328	6 0·8	12 6·9	355					
7 ,,		329	6 1·4	12 6·9	441					
7 ,,		330	6 2·3	12 6·9	230					
7 ,,		331	6 3·3	12 6·6	22					
7 ,,		332	5 58·9	12 6·9	14					
7 ,,		333	5 58·3	11 41·6	94					
7 ,,		334	6 0·3	11 41·2	448					
7 ,,		335	6 2·3	11 40·7	573	...	1·02538			
7 ,,		336	6 4·3	11 39·9	95	...	1·02617			
8 ,,		337	5 51·5	11 18·6	479	...	1·02480			
8 ,,		338	5 56·5	11 17·2	601					
8 ,,		339	6 1·5	11 16·8	351					
8 ,,		340	5 49·4	10 54·6	1036	...	1·02541			
8 ,,		341	5 44·4	10 52·7	913	...	1·02515			
8 ,,		342	5 54·4	10 50·7	897	..	1·02565			
8 ,,		343	6 4·4	10 48·1	934	...	1·02533			
8 ,,		344	6 3·3	11 7·5	547	...	1·02519			
8 ,,		345 T	6 23·3	11 3·8	586	39·42	1·02551	43·45	4·03	336
8 ,,		346	6 29·4	11 24·8	247					
8 ,,		347	6 39·5	11 24·7	379	...	1·02560			
8 ,,		348	6 47·5	11 30·6	426					
9 ,,		349	7 12·7	11 46·8	376					
9 ,,		350	7 38·0	12 3·3	438					
9 ,,		351 T	7 54·6	12 14·7	720	39·28	1·02598	39·38	0·10	620
9 ,,		352 T	8 8·2	12 29·4	571	39·46	1·02602	40·11	0·65	471
9 ,,		353	8 22·7	12 43·3	351					
9 ,,		354	8 36·8	12 57·0	120					
9 ,,		355	8 41·5	13 4·2	61					
9 ,,		356	8 43·5	13 6·8	54					
9 ,,		357	8 45·0	13 9·5	47					
18 ,,		358	6 17·0	12 13·5	10					
18 ,,		359	6 20·6	12 2·8	27					
18 ,,		360	6 24·2	11 52·1	53					
18 ,,		361	6 28·0	11 40·4	70					
18 ,,		361 A	6 28·0	11 33·5	70	...	1·02607			
18 ,,		362	6 22·7	11 33·5	110	...	1·02594			
18 ,,		363	6 17·8	11 25·2	216					
18 ,,		364	6 7·7	11 27·1	187					
18 ,,		365	6 2·6	11 28·0	207					
18 ,,		366	6 4·5	11 28·4	176					
18 ,,		367	6 0·8	11 29·3	442					
18 ,,		368	5 59·3	11 29·5	557	...	1·02566			
18 ,,		369	5 57·2	11 30·0	823	...	1·02568			
18 ,,		370	5 55·1	11 30·7	476	...	1·02581			
18 ,,		371	5 53·0	11 31·1	164					
18 ,,		372	5 50·9	11 31·6	157					
19 ,,		373	5 40·8	11 33·4	178					
19 ,,		374	5 30·7	11 35·2	209					
19 ,,		375	5 20·6	11 37·0	139					
19 ,,	W	376	5 10·5	11 38·7	168					
19 ,,	,,	377	5 10·1	11 29·2	206					
19 ,,	,,	378	5 10·3	11 19·8	474	...	1·02513			
19 ,,	,,	379	5 9·8	11 10·4	737					

[1] Of Fathoms from last Bk.

Date. 1886.	Profile.	No. of Sounding.	Position.		Depth. Fathoms.	Temp. (Fahr.) at Bottom	Density of Bottom Water at 60° Fahr.	Temp. at 250 fathoms from Bottom.		Depth of Second Thermometer.
			Lat.	Long.	D	T	S	t	t−T	D−250=d
19 Feb.	W	380 T	5° 9′·6 S	11 1′·0 E	903	38°·82	1·02560	39°·43	0°·61	653
19 ,,	,,	381 T	5 9·0	10 43·0	1093	37·99	1·02555	39·03	1·04	843
19 ,,		382 T	5 55·3	10 3·6	1637	36·76	1·02551	37·29	0·53	1387
20 ,,		383 T	5 51·7	8 36·5	2124	36·54	1·02597	36·60	0·06	1874
21 ,,		384 T	5 47·7	6 49·5	2538	36·48	1·02563	36·47	−0·01	2288
21 ,,		385 T	5 50·9	5 1·4	2761	36·30		36·42	+0·12	2511
22 ,,		386 T	5 59·4	3 49·4	2937	36·39	1·02562	36·47	0·08	2687
23 ,,		387 T	6 2·2	1 50·7	3000	36·48	1·02593			
23 ,,		388 T	5 58·1	0 1·5	2442	36·48				
24 ,,		389 T	5 58·5	1 24·1 W	2374	36·48				
25 ,,		390 T	5 59·5	3 24·5	2893					
25 ,,		391	6 0·7	5 5·4	2645					
26 ,,		392	6 3·4	6 27·2	2492					
26 ,,		393	5 58·6	8 11·0	2410	...	1·02604?			
27 ,,		394 T	5 58·0	9 31·8	1974	...	1·02618?	36·59	...	1924 (50 fathoms from bottom.)
28 ,,		395 T	5 57·0	11 18·9	1582	...	...	37·17	...	1530
28 ,,		396 T	5 54·0	11 48·0	1688	...	1·02632?	37·08	...	1638
5 Mar.		397	6 0·3	13 24·9	2064					
6 ,,		398	3 59·0	13 28·0	2049					
6 ,,		398 A	4 1·0	13 46·0	2648					
7 ,,		399	2 42·2	14 43·4	2484					
8 ,,		400	1 0·8	14 29·7	1998					
8 ,,		401	0 49·0	14 24·4	2094	...	1·02587			
8 ,,		402 T	0 39·1	14 43·8	1945	36·47				
8 ,,		403 T	0 33·3	14 57·4	2115	36·32				
8 ,,		404 T	0 26·5	15 10·2	2100	36·42				
8 ,,		405 T	0 35·9	15 17·3	1961	36·48				
9 ,,		406	0 4·3	15 57·3	1892					
9 ,,		407	0 1·6	15 56·5	1845					
10 ,,		408 T	0 7·8	14 28·6	2397	35·62				
11 ,,		409 T	0 0·7	13 4·0	2498	35 57	1·02579			500 fathoms from bottom.
12 ,,		410 T	1 17·6 N	13 54·4	2725	36·18	1·02577			
13 ,,		411 T	3 3·4	15 0·9	2611	36·29	1·02576	36·48	0·19	2111

TABLE II.—CONAKRY TO APPI (*Serial Temperatures*).

Station No.	2	3	4	5	6	7	8	9	10	11	Mean.
Latitude, Longitude,	7° 54′ N. 17° 25′ W.	7° 1′ N. 15° 54′ W.	7° 33′ N. 15° 18′ W.	7° 18′ N. 13° 26′ W.	7° 8′ N. 13° 27′ W.	5° 48′ N. 14° 20′ W.	3° 57′·2 N. 7° 42′ 8 W.	3° 0 8′ N. 7° 43′·0 W.	3° 58′ N. 3° 42′ W.	5° 15′·4 N. 3° 10′·0 E.	
Depth,	2623	2584	2406	192	1091	2596	1567	2546	1886	1783	
Date, Jany. 1886.	1st.	2d.	2d/3d.	4th.	4th.	5th.	9th.	10th.	13th.	19th.	
Fathoms	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	82·2	82·9	83·0	83·2	83·4	85·5	82·8	83·0	83·7	83·2	83·29
10	...	...	...	81·42	...	82·48	...	81·7	80·7	76·02*	80·41
20	...	...	...	77·45	...	79·60	...	79·5	77·8	73·91*	77·65
24	...	...	...	...	...	73·78	...	...	...	...	...
25	...	68·9	62·78	...	68·0	69·0	67·2	67·8	67·8	66·8	67·29
28	...	...	...	...	...	67·69	...	...	...	67·53	...
30	...	...	...	68·88	...	...	...	67·1	67·5	...	67·83
32	...	...	...	...	...	64·12	...	...	...	...	...
36	...	...	...	...	...	61·80	...	...	...	...	...
40	...	...	...	63·91	...	60·82	...	61·95	64·31	63·12*	62·82
50	56·85	59·2	58·51	62·15	62·0	58·8	62·3	59·59	61·45	60·9	60·175
57	...	...	...	62·7	...	...	...	...	...	...	...
60	...	...	...	...	...	58·3	...	59·27	59·59	60·1	59·32
70	...	...	...	...	...	...	...	...	58·71	59·47	...
80	...	...	...	...	...	56·94	...	57·80	58·61	58·85	58·05
90	...	...	...	...	...	...	...	...	58·06	58·42	...
100	56·18	56·4	55·51	...	56·2	56·07	58·0	57·5	58·0	58·08	56·88
110	...	...	...	...	...	...	...	...	57·75	57·16*	...
117	...	...	...	...	...	...	...	56·8	...	...	...
120	...	...	...	...	...	...	...	...	56·41	56·99*	...
127	...	...	...	...	...	...	...	56·0	...	...	...

130	...	...	...	...	...	...	...	...	55·91	56·32*	...
140	...	...	...	...	...	...	...	...	54·86	55·07*	...
150	...	...	54·2	...	...	...	...	54·0	52·56	55·4	54·04
170	...	...	...	...	...	...	...	...	51·37	49·68*	...
200	48·82	50·0	50·39	...	49·0	49·0	47·1	46·9	47·83	48·0	48·56
300	45·05	44·2	44·18	...	44·2	44·0	42·38	42·65	43·85	43·03	43·82
400	41·54	...	...	...	41·29	41·08	41·0	40·85	41·06	40·17	41·00
500	40·34	40·9	...	...	40·42	40·32	...	40·03	40·22	39·84	40·30
600	...	...	...	...	40·07	39·77	...	39·71	39·65	39·61	39·76
609	...	...	...	...	40·06	...	..	...	...	...	...
698	...	...	...	..	39·76	...	...	...	...	...	...
700	...	...	...	...	...	39·02	...	39·47	39·40	...	39·30
750	...	39·7	...	...	...	...	...	..	...	...	...
800	...	...	...	...	..	38·58	...	39·24	39·00	39·12	38·98
900	...	...	...	...	38 53	...	...	38·77	...	...	...
1000	...	38·1	...	...	...	38·26	...	38·38	38·45	38·37	38·31
1091	...	...	...	...	38·41	...	...	...	...	..	...
1250	...	37·92	...	...	...	...	...	...	...	37·82*	...
1317	...	...	..	..	...	...	37·45	...	...	...	...
1500	...	36·98	...	...	...	36·98	...	37·96	...	...	36·90
1546	...	...	...	...	...	...	...	...	36·91	37·13*	...
1567	...	...	...	...	...	...	36·83	...	...	...	...
1636	...	...	...	...	...	...	...	...	36·81	...	...
1686	...	...	...	...	...	...	...	...	36·68	...	..
1786	...	...	...	...	...	...	...	...	36·71	36·60	...
1886	...	...	...	...	...	...	...	...	36·48	...	...
2000	...	...	...	...	...	36·51	...	36·51	...	...	...
2296	...	...	...	...	...	...	...	36·54	...	...	...
2546	...	...	...	...	...	...	...	36·47	...	...	...
2584	...	36·06	...	...	...	...	...	...	...	...	...
2596	...	...	...	...	...	36·15	...	...	...	...	...

* For corrected depth, see Table III. (next page.)

TABLE III.—APPI TO ST. PAUL DE LOANDA (*Serial Temperatures*).

Station No.	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Latitude, Longitude,	5° 15′·4 N. 3° 10′·0 E.	4° 12′·7 N. 3° 57′·5 E.	3° 55′·3 N. 4° 7′·3 E.	2° 20′·2 N. 5° 7′·8 E.	1° 55′·5 N. 5° 55′·5 E.	0° 38′·5 N. 6° 26·0 E.	0° 21′·1 N. 7° 33′·0 E.	1° 22′·2 S. 7° 45′·0 E.	1° 6′·2 S. 8° 10′·4 E.	1° 1′·2 S. 8° 19′·7 E.	2° 39′ S. 8° 58′ E.	2° 47·3′ S. 8° 46′·0 E.	4° 26′·7 S. 10° 1′·8 E.	5° 54′ S. 11° 33′ E.	5° 58′·8 S. 11° 50′·3 E.	8° 8′·2 S. 12° 29′·4 E.
Depth Fms.,	1783	1460	1391	1986	1943	1738	1564	1396	757	346	249	658	1534	102	35	571
Date 1886,	19 Jan.	20 Jan.	20 Jan.	21 Jan.	22 Jan.	23 Jan.	29 Jan.	3 Feb.	3 Feb.	3 Feb.	4 Feb.	4 Feb.	5 Feb.	6 Feb.	6 Feb.	9 Feb.
Fathoms.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	83·2	82·7	83·2	82·2	82·9	82·9	83·0	81·4	83·0	82·8	81·7	82·7	82·1	82·0	84·2	79·8
6	..	...	...	...	...	...	...	...	...	...	...	...	..	...	...	72·0
9	76·02	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...
10	...	80·9	81·9	83·0	82·0	80·2	82·7	81·0	81·2	81·1	79·2	78·1	78·8	72·2	71·0	...
13	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	65·7
15	...	78·8	78·7	...	...	...	...	...	...	...	...	...	...	...	...	...
19	73·91	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...
20	...	72·0	77·0	76·4	68·71	68·1	71·0	74·8	71·3	72·3	75·9	76·0	69·0	69·1	70·0	...
21	...	...	...	...	...	...	...	...	.	...	...	...	...	...	...	...
25	66·8	69·8	69·1	...	...	...	...	...	..	.	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...	...	75·63	...	...	...	...
28	67·53	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	...	65·3	63·98	67·0	70·8	71·0	...	70·0	73·0	74·5	67·5	68·0	69·2	...
32	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	61·8
35	...	...	...	...	...	...	...	...	...	...	71·6	...	...	...	...	...
38	63·12	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...
40	...	...	...	...	62·77	...	...	70·28	...	...	..	...	...	...	...	..
41	...	...	...	...	...	...	...	...	...	...	...	72·30	...	...	.	...
47	61·25	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...
50	60·9	61·2	61·7	60·3	61·32	62·0	65·7	63·3	65·0	68·3	66·2	70·8	65·3	64·0	..	60·2
52	...	...	...	...	...	...	...	...	...	...	66·03	..	...	...	...	...
58	...	...	...	...	...	...	...	..	...	...	..	64·59	...	...	...	...
60	60·1	...	...	...	...	...	...	62·68	...	...	...	...	...	...	...	...
64	...	...	...	...	60·25	...	...	...	...	...	...	...	...	...	...	...
69	...	...	...	...	...	...	...	...	...	..	63·12	...	...	...	...	...
70	59·47	...	...	...	..	...	...	..	...	...	...	...	...	...	...	...

75	...	...	...	...	...	..	...	...	...	...	...	...	...	62·3	..	...
77	...	...	...	...	...	...	...	...	...	.	...	62·69	..	...	...	...
80	58·85	...	..	...	...	...	...	59·59	...	...	...	...	...	...	...	...
84	...	...	...	...	59·14	...	...	...	...	...	...	...	...	...	...	...
87	...	...	...	...	...	...	...	...	...	..	60·24	...	...	...	...	...
90	58·42	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...
92	...	...	...	...	...	...	...	...	...	59·54	.	..	..	...	...	...
95	...	...	...	...	...	...	...	...	...	...	...	...	...	60·6	...	...
100	58·08	57·8	57·9	...	58·48	...	59·27	58·68	...	59·1	63·8	61·7	59·5	...	...	56·3
103	58·02	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...
113	57·16	...	...	...	...	...	...	..	...	..	...	...	...	...	..	...
120	...	...	...	...	58·33	...	...	...	...	...	...	...	...	...	...	...
122	56·99	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
126	...	...	...	...	...	...	...	...	...	..	...	58·73	..	...	...	...
132	56·32	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...
140	...	...	...	...	57·13	...	...	...	..	.	...	...	...	...	...	...
141	55·07	...	...	...	...	...	..	...	...	...	...	...	...	...	...	..
145	54·81	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...
149	...	...	...	...	...	...	...	...	...	...	55·54	...	...	..	..	.
150	55·4 (?)	...	...	...	51·13	...	51·21	...	...	...	...	...	...	..	...	...
154	53·15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
163	51·45	...	...	...	...	...	...	...	...	...	...	.	...	...	...	..
172	49·68	...	...	...	...	...	...	..	..	...	..	..	...	..	..	...
181	48·50	...	...	...	...	...	...	..	...	...	...	.	...	..	...	...
190	...	...	...	...	47·98	...	...	...	...	...	...	...	...	..	...	...
200	48·0	...	...	...	49·95	...	47·71	48·0	...	...	...	...	55·0	..	...	47·8
249	...	...	...	...	...	...	...	...	...	...	48·98	...	.	...	...	...
300	43·03	...	...	...	45·07	...	42·84	42·27	...	...	..	...	44·68	...	...	..
342	...	..	...	..	...	...	...	...	...	42·03	...	...	...	.	.	...
371	...	..	...	...	...	...	...	...	..	...	...	...	...	...	...	42·43
400	40·17	...	..	...	42·51	...	40·96	40·02	...	..	...	...	41·45	...	...	...
408	...	...	..	...	...	..	...	...	..	...	..	...	...	...	...	...
471	...	...	...	...	...	...	...	...	..	...	...	...	...	...	.	40·11
500	39·84	...	...	...	39·87	...	39·56	39·60	...	...	.	...	...	...	...	...
507	...	...	..	...	...	...	...	...	39·98	...	...	...	..	...	...	...
571	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39·46
600	39·61	...	...	...	39·61	..	39·45	39·44	..	...	...	...	39·51	...	...	...

TABLE III.—APPI TO ST. PAUL DE LOANDA (*Serial Temperatures*).—*Continued.*

Station No.	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Latitude, Longitude,	5° 15′·4 N. 3° 10′·0 E.	4° 12′·7 N. 3° 57′·5 E.	3° 55′·3 N. 4° 7′·3 E.	2° 20′·2 N. 5° 7′·8 E.	1° 57′·5 N. 5° 5′·5 E.	0° 38′·6 N. 6° 25′·8 E.	0° 21′·1 N. 7° 33′·2 E.	1° 22′·2 S. 7° 45′·0 E.	1° 6′·2 S. 8° 10′·4 E.	1° 1′·2 S. 8° 19′·7 E.	2° 39′ S. 8° 58′ E.	2° 47′·3 S. 8° 46′·0 E.	4° 26′·7 S. 10° 1′·8 E.	5° 54′ S. 11° 33′ E.	5° 58′·8 S. 11° 50′·3 E.	8° 8′·2 S. 12° 29′·4 E.
Depth Fms.,	1783	1460	1391	1986	1943	1738	1564	1396	757	346	249	658	1534	102	35	571
Date 1886,	19 Jan.	20 Jan.	20 Jan.	21 Jan.	22 Jan.	23 Jan.	29 Jan.	3 Feb.	3 Feb.	3 Feb.	4 Feb.	4 Feb.	5 Feb.	6 Feb.	6 Feb.	9 Feb.
Fathoms.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.
658	...	..	...	...	...	...	...	...	...	...	...	39·46	...	...	...	...
700	...	..	...	...	39·90	...	...	...	...	...	...	...	...	...	...	...
750	...	...	...	...	39·47	...	...	...	...	...	...	...	...	...	...	...
757	...	..	...	...	...	...	...	...	39·32	...	...	...	...	...	...	...
860	39·12	..	...	...	...	...	39·16	39·29	...	..	..	..	39·23	...	...	...
1000	38·37	..	...		38·75	...	38·29	38·45	.	...	...	...	...	...	...	...
1034	...	...	..	...	...	...	..	..	...	...	...	...	38·30	...	...	...
1146	...	.	..	...	...	...	...	38·07	...	...	...	..	..	...	...	..
1200	37·82	.	..	...	...	...	..	..	...	...	...	..	...	...	...	...
1250	...	...	..	..	37·99	...	...	...	...	..	...	..	...	...	...	...
1284	...	..	..	...	...	...	...	...	...	..	...	..	37·60	..	...	...
1314	...	...	...	...	...	...	37·34	.	...	...	...	...	...	...	...	...
1391	...	...	37·22	...	...	...	...	...	...	.	..	...	...	...	...	..
1396	...	..	...	...	...	...	..	37·30	...	..	...	..	...	...	...	...
1460	...	37·08	...	...	...	...	...	...	...	...	..	...	...	...	...	...
1488	...	...	...	...	...	37·21	...	...	...	...	...	...	...	...	...	...
1500	...	...	..	..	37·49	...	.	...	...	...	...	...	...	...	...	..
1533	37·13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1534	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1564	...	..	...	...	...	...	35·52	...	.	..	...	..	37·03	...	...	...
1693	...	...	...	..	36·90	...	...	...	...	...	...	...	...	...	...	...
1738	...	...	...	...	...	36·71	...	...	..	..	...	...	...	...	...	...
1783	36·60	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
1943	...	...	..	...	36·54	...	...	...	...	...	...	...	...	...	...	...
1986	...	...	...	36·58	...	...	...	...	...	...	..	...	...	...	...	...

Station No.	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Latitude.	5° 9′·0 S.	5° 51′·7 S.	5° 47′·7 S.	5° 50′·9 S.	5° 59′·4 S.	6° 2′·2 S.	5° 58′·1 S.	5° 58′·5 S.	5° 59′·5 S.	6° 0′·7 S.	6° 3′·4 S.	5° 58′·6 S.	5° 56′·3 S. 5° 58′·0 S.	5° 54′·0 S.	6° 0′·3 S.
Longitude.	10° 43′·0 E.	8° 36′·5 E.	6° 49′·5 E.	5° 1′·4 E.	3° 49′·4 E.	1° 50′·7 E.	0° 1′·5 E.	1° 24′·1 W.	3° 24′·5 W.	5° 5′·4 W.	6° 27′·2 W.	8° 11′·0 W.	9° 32′·6 W. 9° 31′·8 W.	11° 48′·0 W.	13° 24′·9 W.
Depth. Fms.	1093	2124	2538	2761	2937	3000	2442	2374	2893	2645	2492	2410	1924	1638	2064
Date, 1886.	19th Feb.	20th Feb.	21st Feb.	21st Feb.	22d Feb.	23d Feb.	23d Feb.	24th Feb.	25th Feb.	25th Feb.	26th Feb.	26th Feb.	27th Feb.	28th Feb.	5th Mar.
Fathoms.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	82·8	83·6	82·2	81·7	83·0	81·8	81·0	81·0	80·0	81·0	80·5	79·8	80·6	81·0	81·0
10	82·3	79·4	80·8	79·8	82·6	80·2	80·9	79·3	79·8	80·4	80·0	80·1	80·5	80·0	80·2
15	...	68·7	75·0	72·5	72·9	77·8	...	...	...	..	...	..	...	...	...
16	...	...	...	...	71·81	...	...	..	...	...	...	...	...	...	...
17	74·1	...	...	...	70·05	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	68·83	...	...	...	...	...	...	...	...	..	...
19	...	...	...	...	67·89	...	...	.	...	...	...	...	...	...	...
20	...	64·2	67·8	68·0	66·10	75·2	76·3	75·0	79·8	80·0	78·2	79·8	79·8	80·0	80·2
25	...	...	...	...	...	...	...	74·5	...	...	...	...	...	...	...
30	67·0	62·7	61·2	62·9	61·3	66·3	67·7	73·3	75·0	74·0	73·2	74·0	77·0	76·0	79·0
39	...	...	...	...	59·23	...	...	...	...	...	...	...	74·82	...	...
40	...	...	...	...	...	...	...	66·98	...	...	...	...	...	73·4	73·0
47	...	...	...	...	...	...	...	...	...	...	...	...	66·2	...	...
50	64·2	60·6	59·1	58·3	58·6	60·0	60·7	61·5	64·0	62·3	59·2	66·5	...	68·9	69·2
58	...	...	...	...	58·18	...	...	...	...	...	...	...	...	...	...
59	...	...	...	...	...	...	...	...	...	...	...	...	62·82	...	...
60	...	...	...	...	...	...	...	59·43	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...	...	...	54·5	53·0	...	57·2	57·2
77	...	...	...	...	57·11	...	...	...	...	...	...	...	...	...	...
79	...	...	...	...	...	...	...	...	...	...	...	...	54·32	...	...
80	...	...	...	...	...	...	...	54·96	...	...	...	...	...	...	...
85	...	...	...	...	...	...	...	...	53·5	...	...	...	...	...	...
97	...	...	...	...	56·06	...	...	...	...	...	...	...	...	...	...
98	...	...	...	...	...	...	...	...	...	...	...	...	51·84	...	...
100	58·0	57·9	56·3	56·0	55·0	54·3	52·0	52·38	50·3	52·6	51·8	50·1	51·6	51·3	52·0
139	...	...	...	...	...	...	...	...	...	...	...	...	...	48·3	...
145	...	...	...	...	52·56	...	...	...	...	...	...	...	...	...	...
150	52·0	54·6	...	...	...	...	...	49·28	49·5	...	...	...	51·05	...	...
185	...	..	...	...	...	...	...	..	...	...	...	...	...	46·1	...
188	...	...	...	...	46·7	...	...	...	...	...	...	...	...	...	...
200	47·1	49·1	...	...	...	...	...	47·2	47·0	...	...	...	47·01	...	...
241	...	...	...	...	44·39	...	...	...	...	...	...	...	...	...	...
250	...	...	...	...	...	..	...	44·34	...	...	...	..	44·30	...	...
300	43·21	42·99	...	...	42·02	...	...	42·68	...	...	...	...	42·64	...	...
347	...	...	...	..	...	...	...	...	...	...	...	...	40·42	...	...
400	40·66	40·27	...	...	40·27	...	...	40·41	...	...	...	...	...	...	...
500	39·40	39·48	...	...	39·53	...	...	39·16	...	...	...	...	...	...	...

TABLE IV.—ST. PAUL DE LOANDA TO ASCENSION (*Serial Temperatures*)—*Continued.*

Station No.	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Latitude.	5° 9′·0 S.	5° 51′·7 S.	5° 47′·7 S.	5° 20′·9 S.	5° 59′·4 S.	6° 2′·2 S.	5° 58′·1 S.	5° 58′·5 S.	5° 59′·5 S.	6° 0′·7 S.	6° 3′·4 S.	5° 58′·6 S.	5° 56′·3 S. 5° 58′·0 S.	5° 54′·0 S.	6° 0′·3 S.
Longitude.	10° 43′·0 E.	8° 36′·5 E.	6° 49′·5 E.	5° 1′·4 E.	3° 49′·4 E.	1° 50′·7 E.	0° 1′·5 E.	1° 24′·1 W.	3° 24′·5 W.	5° 5′·4 W.	6° 27′·2 W.	8° 11′·0 W.	9° 32′·6 W. 9° 31′·8 W.	11° 48′·0 W.	13° 25′·0 W.
Depth. Fms.	1093	2124	2538	2761	2937	3000	2442	2371	2893	2645	2492	2410	1924	1638	2064
Date, 1886.	19th Feb.	20th Feb.	21st Feb.	21st Feb.	22d Feb.	23d Feb.	23d Feb.	24th Feb.	25th Feb.	25th Feb.	26th Feb.	26th Feb.	27th Feb.	28th Feb.	5th Mar.
Fathoms.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr. 39·42	° Fahr.	° Fahr.
520	...	...	...	...	...	...	...	..	...	...	...	...		...	...
600	39·51	39·42	...	...	39·38	...	...	39·14	..	...	...	...	...	...	...
692	...	...	...	...	...	...	..	...	...	...	...	...	39·23	...	..
700	39·32	39·23	...	...	39·00	...	...	39·19	...	...	...	...	...	...	...
800	...	...	...	...	38·90	...	...	38·49	...	...	...	...	39·00	...	...
843	39·03	...	...	...	...	...	...	...	...	...	...	...	...	...	...
900	...	38·54	...	...	...	...	...	38·44	...	...	...	...	...	...	...
1000	...	38·22	...	...	38·23	...	...	38·23	...	...	...	...	39·07	...	...
1093	37·99	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1200	...	37·77	...	...	...	...	...	37·60	...	...	...	...	37·95	...	...
1242	...	...	...	..	...	...	37·40	...	...	...	...	...	...	...	...
1400	...	37·26	.	...	37·15	...	...	37·14	...	...	...	..	37·99	...	...
1600	...	...	...	...	...	...	...	...	..	...	...	...	36·99	...	...
1624	..	36·87	...	...	...	...	...	36·76	...	...	...	...	...	...	...
1638	...	...	.	...	...	...	...	...	.	...	...	...	...	37·08	...
1642	...	...	...	...	...	...	36·86	...	...	...	...	...	...	...	...
1800	...	...	...	...	36·64	...	...	...	...	...	...	...	36·58	...	...
1874	...	36·60	...	...	...	...	...	36·50	...	...	...	...	...	...	...
1924	...	...	...	...	..	...	...	...	...	...	...	...	36·59	...	...
2000	...	...	...	...	36·48	...	...	...	..	...	...	...	...	...	...
2038	...	...	36·50	...	...	...	...	...	...	...	...	...	...	...	...
2124	...	36·54	...	...	.	...	.	...	...	...	...	...	...	...	...
2134		.	...	...	..	...	...	36·51	...	...	...	...	...	...	...
2200	...	...	...	...	...	36·46	...	...	...	...	...	...	...	...	...
2261	...	...	...	36·33	...	...	...	...	...	...	...	...	...	...	...
2279	...	...	36·47	...	...	...	...	...	...	...	...	...	...	...	..
2374	...	...	...	...	..	...	...	36·48	...	...	...	...	...	...	...
2442	...	...	...	...	...	...	36·48	...	...	...	...	...	...	...	...
2437	...	...	...	...	36·38	...	...	...	...	...	...	...	...	...	...
2500	...	...	..	...	..	36·50	...	..	...	...	...	...	...	...	...
2511	...	...	...	36·42	...	...	...	...	...	...	..	...	...	...	...
2538	...	...	36·48	...	...	...	..	...	...	...	...	...	...	...	...
2687	...	...	...	...	36·47	...	...	...	...	...	...	...	...	...	...
2761	...	...	...	36·30	...	...	...	...	...	...	...	...	...	...	...
2937	...	...	...	...	36·39	...	...	...	...	...	...	...	...	...	...
3000	...	...	...	...	...	36·48	..	...	...	...	...	...	...	...	...

TABLE V.—ASCENSION TO CONAKRY (*Serial Temperatures*).

Station No.	41	42	43	44	45	46	47	48	3
Latitude,	6° 0′·3 S.	3° 59′·0 S.	2° 42′·2 S.	0° 4′·3 S.	0° 7′·8 S.	0° 0′·7 N.	1° 17′·6 N.	3° 3′·4 N.	7° 1′·0 N.
		4° 1′·0 S.	2° 45′·6 S.		0° 6′·2 S.		1° 15′·6 N.	3° 2′·3 N.	
Longitude,	13° 24′·9 W.	13° 28′·0 W.	14° 43′·4 W.	15° 57′·0 W.	14° 28′·6 W.	13° 4′·0 W.	13° 54′·4 W.	15° 0′·9 W.	15° 54′·0 W.
		13° 46′·0 W.	14° 53′·0		14° 26′·5 W.	13° 1′·5 W.	13° 59′·2 W.	15° 2′·1	
Depth,	2064	2648	2484	1892	2397	2498	2725	2611	2584
Date 1886.	5 March.	6 March.	7 March.	9 March.	10 March.	11 March.	12 March.	13 March.	2 Jany.
Fathoms.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	81·0	81·6	81·5	81·0	81·6	80·8	82·3	83·1	82·9
10	80·2	81·0	81·2	79·2	79·8	80·0	82·0	83·0	...
15	...	76·1	81·0	78·8	...	...	...	...	...
18	...	...	...	76·3	...	...	...	...	...
20	80·2	73·7	81·0	...	80·0	76·7	81·9	81·2	...
20	...	...	...	...	78·4	...	...	...	...
23	...	...	...	74·2	...	...	...	...	...
25	...	...	65·2	...	...	...	76·2	74·8	68·9
30	79·0	67·9	61·8	...	63·3	65·0	64·8	66·0	...
30	...	...	...	...	...	67·8	...	...	...
32	...	...	...	71·0	...	...	...	...	...
40	73·0	...	...	...	...	...	...	61·2	...
50	...	59·9	57·3	...	59·2	59·0	57·8	60·0	59·2
75	57·2	56·46	56·2	...	56·7	56·9	56·2	58·0	...
100	52·0	54·92	55·8	...	55·8	56·0	55·8	56·5	56·4
150	...	...	52·7	...	50·9	51·2	51·9	54·2	...
200	...	52·83	49·2	...	47·2	46·9	48·0	47·7	50·0
300	...	48·64	42·63	...	...	...	43·86	42·41	44·2
400	...	42·21	40·95	...	...	...	40·67	40·98	...
500	...	...	...	...	...	...	...	. .	40·9
600	...	...	39·41	...	...	...	39·70	39·75	...
800	...	...	39·30	...	...	...	39·55	39·35	...
1000	...	...	...	...	...	...	38·35	38·35	38·1
1250	...	...	...	...	...	...	37·66	37·76	37·92
1500	...	...	...	...	...	...	36·99	...	36·98
2000	...	...	...	...	...	...	36·54	...	...
2111	...	...	...	...	...	...	...	36·48	...
2397	...	...	...	...	35·62	...	...	...	...
2498	...	...	...	...	...	35·57	...	...	...
2611	...	...	...	...	...	...	...	36·29	...
2725	...	...	...	...	...	...	36·13	...	...

A BATHYMETRICAL SURVEY OF THE CHIEF PERTHSHIRE LOCHS AND THEIR RELATION TO THE GLACIATION OF THAT DISTRICT.

By James S. Grant Wilson, H.M. Geological Survey.

(*Read before the Royal Society, Edinburgh, Feb.* 20, 1888. *Communicated by permission of the Director-General.*)

Situated within the Highlands of Perthshire are numerous fresh-water lochs, each surrounded with its own peculiar type of scenery. Notwithstanding this diversity, there are certain broad features which are common to them all, and suggest that the same agencies have been at work

in each case. During the progress of the Geological Survey in this part of the country four of these have been sounded, and the results obtained show the close connection that exists between the configuration of the various rock basins, and the glaciation of the district in which they are situated. The general trend of the chief Perthshire valley is from west to east, and these are in turn intersected by the transverse valley running south-east from the head of the Garry to Dunkeld. The river Tay belongs to both these systems; the upper portion flowing in an easterly direction from the head of Glen Dochart to Ballinluig, thence along the transverse valley in a south-east direction by Dunkeld to Perth. At Ballinluig the Tay receives the outflow from Lochs Rannoch and Tummel, while the surplus water of Loch Earn passes through Strath Earn, and joins the estuary a little to the west of Newburgh.

In surveying these various lochs the system adopted was to take a series of soundings (50-80 yards apart) along parallel lines from one side of the lake to the other. These parallel lines were fixed at intervals of about a quarter of a mile, and the observations were checked by other soundings taken in lines extending diagonally across several of the former. A steam launch was employed on Loch Tay, while for the other lakes an ordinary rowing boat proved sufficient.

Loch Rannoch.—This sheet of water, $9\frac{1}{4}$ miles in length and having a mean breath of $\frac{3}{4}$ of a mile, lies to the east of the Moor of Rannoch and at an elevation of 667·5 feet. This moor is a wild expanse of peat-moss and heather, and over its surface are scattered numerous small lakes and lochans which all drain into Loch Rannoch. From the east shore of the loch the bottom descends very steeply, and at one point midway between Altruigh and Carie the greatest depth of 70 fathoms was obtained. Here the loch is a mile broad, and the depth of 70 fathoms is $1\frac{3}{4}$ of a mile from the east end—giving an average grade for the central plane of 1 in 22. From the deepest point to where the 10-fathom contour-line crosses the loch opposite Killichonan, the central plane rises with tolerable regularity to the west with an average grade of 1 in 88. Between the 50 and 60 fathoms contour-lines the grade is 1 in 30, but this rise only continues for a short distance. At Carie, Aulich, Killichonan, and Crosscraig four large burns flow into the loch, and the stony detritus borne down by these has in each case formed a large cone of alluvium that projects for a considerable distance into the lake. As might be expected, the depth of the lake suddenly increases along the face of these cones, each resembling the tip end of a railway bank. Several measurements showed their angle of slope to be considerably in excess of 20°. In the deep water only two small banks have been discovered: one lies opposite the mouth of Dall burn, near to the north side and 29 fathoms from the surface, while the other is situated in the middle of the loch, to the north of Crosscraig, in $16\frac{1}{2}$ fathoms of water. The general transverse section of this loch is in the form of a V, the bottom sloping down from the one side till the maximum depth is reached, and then immediately rising towards the opposite shore. The only exception to this is the small area to the south-west of the Killichonan burn, where the bottom

is very flat—but this may in part be due to the silting up now in progress at this end. To the south of the Tower Island the water is very shallow, the main channel passing to the north of the island with an average depth of 8 fathoms. Between the mouth of the Ericht and Rannoch Lodge there is a small depression to the extent of $13\frac{1}{2}$ fathoms at its deepest point.

From Kinloch-Rannoch to Aulich the north side of the basin shows a steep gradient towards the centre, becoming less steep to the west of Aulich. The same steep gradient also prevails along the south shore as far as Dall, but between Altruigh and Carie a belt of shallow water, about 150 yards in breadth, lies between this sharp descent and the margin of the lake.

In almost every case where the sounding-line brought up a sample of the bottom, it was found to consist of a very fine brown vegetable mud through which were scattered small particles of white mica. In the shallow water to the east and west of Killichonan this mud was often of a rusty brown colour, due to the presence of a small quantity of iron, and from the Tower Island to the mouth of the river Ericht the bottom was almost entirely composed of fine sand. The west end of this loch is slowly silting up by the deposition of sediment. But this is necessarily a very slow process. The two main feeders at this end, the Ericht and the Ghaoir, respectively drain Lochs Ericht and Laidon a few miles distant. Owing to the precipitation of sediment in these lakes, the amount of suspended matter carried into Loch Rannoch by the Ericht and Ghaoir is small in proportion to their volume.

One of the most important features connected with the glaciation of Perthshire is the remarkable fact that during the period of extreme cold, the *ice-shed* did not coincide with the watershed of this part of the country. During the maximum glaciation, the ice-parting lay between Kinloch-Rannoch and Tummel Bridge, about 20 miles to the east of the existing watershed. Bearing this in mind, we can satisfactorily account for the phenomenon that the deepest part of Loch Rannoch should be found at its eastern end. The ice, as it passed along the strath of Rannoch from east to west, would naturally exert the greatest eroding power at the point where the glacier began to move outwards from the centre of dispersion. Hence we find the greatest depth at the eastern end, which gradually diminishes from this point to the western extremity. The loch thus presents the simplest form of a rock basin due to ice erosion. Striæ indicating this ice-movement have been found on the hillsides to the south-east and north-east of the loch, along with others belonging to the later valley glaciation. After passing along Loch Rannoch, this great body of ice, reinforced by the ice from the Loch Ericht basin, would stream over the low ground that forms the Moor of Rannoch, and find its way to the west by Glen Leven, Glen Etive, and Glen Orchy.

Between Clach-ghlas and Tigh-moir, the eastern margin of the loch is composed of banks of shingle. For a mile to the east of this, a flat gravel moor forms the valley bottom. Between Tomclachach and Dalchosnie rock rises above this alluvial haugh, and, stretching more than halfway across the valley, appears to mark the position of the original lip

of the rock basin of Loch Rannoch. If this supposition be correct, the ice formed a rock basin, with an average downward inclination of 1 in 34 for $2\frac{3}{4}$ miles, and rising again to the west for $7\frac{1}{2}$ miles, with a gradient of 1 in 88. A few gravel-pits have been opened on this flat to the east of Tigh-moir, and an examination of their contents shows that the stony material is largely moranic in its character. The accumulation of so large a quantity of moranic *débris* at this part of the valley is doubtless due to the fact that it formed one of the terminal moraines of the later glaciers. As the waves on the surface of this lake are constantly breaking along its eastern margin, they have converted the moranic detritus at this point into shingle, which has been thrown up into a series of small storm beaches. That the river Tummel did not always leave the loch by its present course, is proved by the existence of a well-marked channel along the south margin of the valley. The river, thus moving from side to side, would remove the irregular mounds scattered over the surface of this terminal moraine, and leave the broad flat moor that now lies between Kinloch and Dalchosnie.

The small depression already mentioned, that lies between the mouth of the river Ericht and Rannoch Lodge, is doubtless due to the junction of the Ericht and Rannoch ice at this point.

With the exception of a small area of granite at the west end, the rock basin of Loch Rannoch has been entirely eroded out of micaceous quartz-schist, with bands of quartzite and mica-schist. Through these are intruded sills of quartz-porphyry and altered basic rocks; and as the general dip of the beds is to east, the denudation of this rock basin has been at a right angle to their strike.

Loch Tummel.—This lake lies $9\frac{1}{2}$ miles to the east of Loch Rannoch, with which it is connected by the river Tummel. The surface of the lake is 453·5 feet above sea-level, or 214 feet lower than Loch Rannoch. Although the total length of this loch is only $2\frac{3}{4}$ miles, its physical structure is very interesting, as it contains three distinct basins.

The deepest basin is found at the west end of the loch. Its maximum depth is $20\frac{2}{3}$ fathoms, and the area embraced by the 20-fathom line is situated at the upper end of the basin. This basin is separated from the middle one by a sill of rock covered with $8\frac{1}{2}$ fathoms of water at its deepest point. This sill coincides with a large fault, with downthrow to east. The beds on the west side of this fault are the soft grey mica-schists that overlie the crystalline limestones of Glen Tilt and Loch Tay; while on the east side of the fault, the hard upper quartzite beds occur that form the south side of Strath Tummel. The middle basin has been excavated entirely out of these hard quartzites, and its greatest depth of $19\frac{1}{2}$ fathoms is also found at the upper end of the basin. The lower basin is divided from the middle one by a similar rock sill in 9 fathoms of water. This basin is the smallest of the three, and has a central depth of $16\frac{1}{2}$ fathoms.

Taking these facts into consideration, it is clear that they are quite in accordance with the belief that Loch Tummel is a rock basin, excavated by ice. On the hill slopes on either side of the loch abundant

striæ are met with, showing that the direction of the ice-movement was E. 15° to 30° S. We would naturally expect, therefore, to find proofs of greatest erosion at the western ends of the rock basins. A glance at the chart will show how the contours of the several basins in Loch Tummel illustrate this phenomenon, and how the two upper ones, each about a mile in length, gradually diminish in depth towards the east.

Another point of interest presented by this loch is the fact that the relative hardness of the rock out of which these basins have been excavated seems to have made no difference to the grinding power of the glacier. As mentioned above, the upper basin lies entirely in soft grey mica-schist, while the two lower ones have been scooped out of hard quartzite rock.

Loch Tay.—This sheet of water, the largest of the Perthshire lakes, is 14½ miles in length, with an average breadth of about ¾ of a mile. Calculated from the bench mark on Kenmore Bridge, the mean surface level of its water is found to be 346 feet. In outline it is very similar to the letter *S*. The lower portion of the letter is represented by the part from Killin to Ardeonaig, and extends E. 25° N. From Ardeonaig to Fernan the axis of the lake lies N. 30° E., and from the latter point to Kenmore it resumes its original direction of E. 25° N. At the west end it is fed by two considerable rivers—the Dochart and Lochay; and from Killin to Kenmore it drains the hill basin in which it lies by means of numerous small streams. The largest of these are the Ardtalnaig, Ardeonaig, Morenish, and Lawers burns.

The rivers Lochay and Dochart join a short distance below the village of Killin, and from the point where their combined waters enter the loch to the steamer pier the western margin of the loch is very shallow. About ⅔ of a square mile of marshy ground lie between Killin and Loch Tay, and this has been formed by the detritus brought down and deposited by these two rivers. That this alluvial flat has a considerable depth is shown by the fact that a bore of 12 fathoms, put down where the railway bridge spans the Lochay, failed to find a rock bottom. The silting up of the loch at its west end is proceeding rapidly. Since 1861, when the ground was surveyed by the Ordnance Survey, the spit on the north side of the mouth of the conjoined rivers has advanced ⅓ of a mile further into the loch, while a considerable portion of it has been raised by drifted sand above the surface of the water, and is now covered with scrub and grass. At the extremity of this spit the river water, in joining the loch, has formed a bar, and beyond it the depth of water increases very rapidly. To the east of Firbush Point very shallow water lies along the shore, with a sand spit that extends about 200 yards into the loch, and in the direction of the river bar.

When the loch is standing at its summer level, the sandy shore around its western margin is often covered with patches of bright red sand. This red sand forms a thin layer on the surface of the ordinary yellow siliceous sand that lines the shores. On examination it is found to be almost entirely composed of minute fragments of garnets, and these particles, on account of their lighter specific gravity, have been sifted out

by the moving water from the denser siliceous materials, and deposited on the top of them.

To the south of the steamer pier the loch is very shallow for about a $\frac{1}{4}$ of a mile from the shore, but beyond this the depth rapidly increases till 24 fathoms is reached. From this point eastwards the bottom of the loch slopes gently downwards, till, at a distance of $3\frac{1}{2}$ miles from Killin, it is covered with 50 fathoms of water. This gives an average grade for the central plane of 1 in 61. A transverse section across the basin opposite Creagard shows that the sides slope evenly downwards to the maximum depth, the declivity of the south slope being twice as great as that on the north side. From Creagard to Ardeonaig the lake becomes slightly shallower, and has an average depth of 46 fathoms of water. From Ardeonaig to Skiag the central plane again descends with considerable regularity to the east, with an average grade of 1 in 100. To the south of Balnahanaid the bottom of the loch is situated below sea-level, and continues so for a distance of six miles to the north-east. From Tullochcan to Ardtalnaig numerous transverse sections have been plotted across the basin. These all show that the sides slope regularly down till the maximum depth at any one point is reached, and that the bottom there for about $\frac{3}{5}$ of the distance across is almost level.

Below Skiag is situated the deepest portion of Loch Tay, covered with 85 fathoms of water, and at this point the bottom is 164 feet below sea-level. Here the loch is only 1110 yards wide, and this is the narrowest part between Ardeonaig and Acharn. A transverse section of the loch between Skiag and Cragganruar shows that both sides slope steeply downwards to the maximum depth. Between Skiag and Kenmore the central plane rises with tolerable regularity to the east, with an average grade of 1 in 57. Several sections have been plotted across the lake between these two points, which show that the bottom is rather irregular, and that the south side of the basin is much steeper than the north. The chief burns that flow into the loch at Acharn, Ardtalnaig, Lawers, Ardeonaig, and Morenish formed large cones of detritus that project for some distance into the lake. The face of these is very steep, and deep water is found close inshore. All over the loch the sounding-line brought up samples of the bottom, and this almost invariably consisted of very fine mud, composed of impalpable fragments of peat and vegetable *débris*, mixed with small scales of mica. In the bay at Fernan, and between Acharn and Kenmore, stiff yellow clay formed the bottom, while the west end is chiefly occupied with fine sand.

At the time when the great *mer de glace* covered the whole of Scotland, it moved over this part of the country in a south-easterly direction. Numerous grooves and striæ have been found on the hill slopes and summits on both sides of the loch, and these show the direction of the movement to have been E. 20° to 30° S. Between Ardtalnaig and Auchreich the ground rises rapidly from the edge of the loch to 2340 feet, and the shoulder of Ben Lawers that faces it on the north side is correspondingly steep. (*See section on chart.*) The slope to the north of Ardtalnaig is almost destitute of any covering of drift, and the quartz-porphyry, that forms the rock *in situ*, exhibits marks of intense glacial

action and has been grooved, striated, and polished in many places. The direction of these striæ range from N. 30° to 35° E., and the appearance of the striæ shows that the ice passed from south to north, although some of these may belong to later valley glaciation. I am inclined to believe, from a consideration of the whole evidence, that they were formed by an undertow of the great ice-sheet. Where the steep slope at Ardtalnaig prevented the direct passage of the ice, the under current, deflected for a short distance to the north-east, must have had a powerful erosive effect along the base of the slope. The pressure would be intensified by the confined nature of the valley. Hence the deepest part of the Loch Tay basin would naturally be formed where we now find it, between Ardeonaig and Fernan. Owing to this undertow the bottom layers of ice would travel eastwards towards Kenmore till the decrease in the height of the hills to the south allowed of their passing over them. The direction of this movement would then coincide with that of the main mass, viz., E. 20° S.

It is important to note that between Ardeonaig and Fernan a large fault occurs with a downthrow to the west. The points at which it enters the loch at both these places have been accurately fixed, and its probable position along the bottom has been indicated on the chart. The fault in the first instance may have determined the direction of the loch between these two points, but in my opinion it does not explain why the deepest portion of the basin is situated at Skiag. Had Loch Tay been an ordinary type of rock basin the greatest depth would been found somewhere to the west of Ardeonaig; but the soundings, viewed in connection with the other glacial phenomena, show that it is a very good type of a deflection basin.

Loch Earn.—This loch lies 6 miles due south of the Killin end of Loch Tay. It is $6\frac{1}{2}$ miles in length, and is situated at an elevation of 306 feet above sea-level. It receives the drainage of the surrounding country by means of numerous small streams, while the surplus water is discharged into the river Earn, which flows out at the east end. Inshore around Lochearnhead the upper end is shallow, but beyond this the depth steadily increases till the deepest sounding of 48 fathoms is reached to the north of Ardvorlich. This gives an average grade for the central plane of 1 in 46. A transverse section of the lake at this point shows a flat-bottomed trough, with a sharp declivity on the south side. From Ardvorlich to St. Fillans the central plane rises with great regularity with an average grade of 1 in 74. Transverse sections of this portion of the loch show that it has a very flat bottom, and the south slope of this rock basin is twice as steep as that on the north side. Everywhere the basin is covered with a brownish-black vegetable mud, similar to that found in the three lochs already described.

Loch Earn thus presents the simplest form of rock basin, and as the great *mer de glace* passed over this portion of the country in an ESE. direction it naturally exercised the greatest pressure along the south side of the valley, and this is the reason why the southern side of this rock basin is twice as steep as its northern slope. The same fault that runs through a portion of Loch Tay intersects the upper part of Loch Earn,

but it does not seem to have exercised any influence upon the direction or configuration of this basin. Cones of detritus have been formed by all the large burns that flow into this loch with deep water close inshore. This loch was partially sounded by Mr. Sandison of St. Fillans, and the record of these I have used, supplemented by those soundings taken by myself.

A SHORT GEOGRAPHICAL AND HISTORICAL SKETCH OF BOSNIA AND THE HERZEGOVINA.

By E. B. Freeman, H.B.M. Consul, Bosna-Serai.

The whole of Bosnia and the Herzegovina belongs to the "Karst" district, which may be said to extend from the Kraïna to the southernmost point of Greece. What is understood by "Karst" is a rocky formation with only a slight depth of soil, wooded in some parts, but where the forests have been destroyed, and the soil consequently washed away, presenting a barren, inhospitable, undulating, rocky surface.

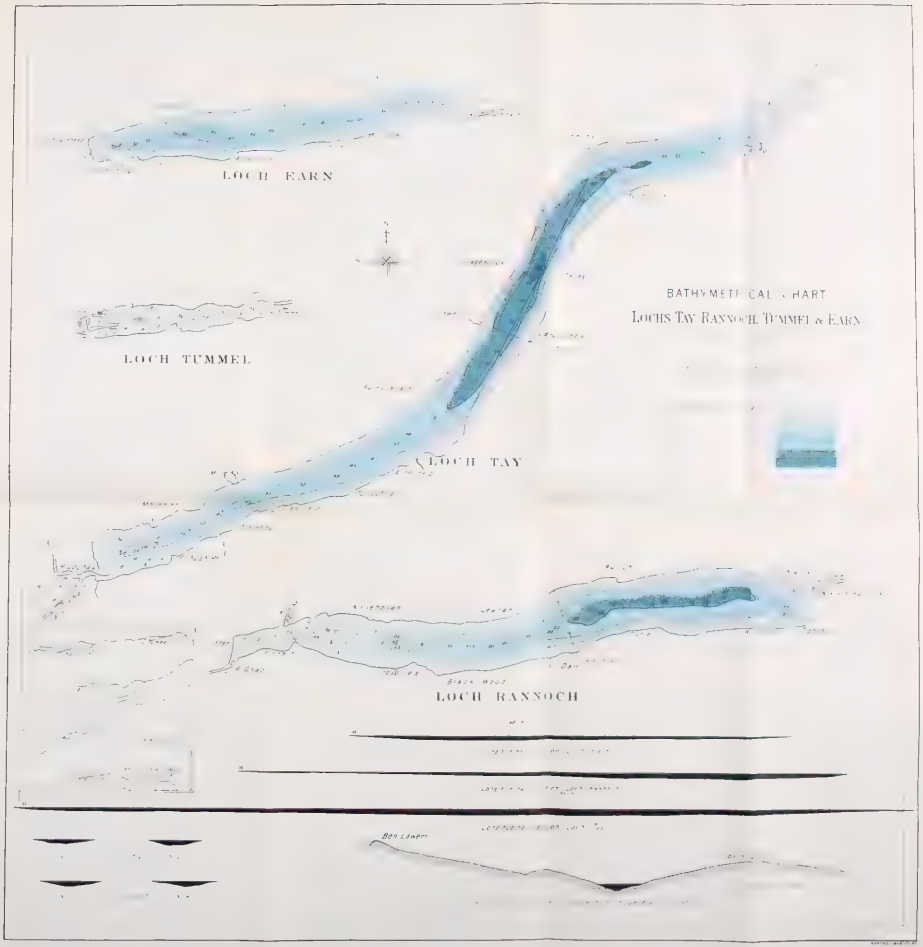
Everywhere in Bosnia are to be seen the deeply-indented mountain-sides of chalk or limestone, lying chiefly on a substratum of clay-slate, peculiar to the Karst formation, and the deep-cut valleys and river-beds between wall-like rocks not unfrequently 1000 to 1200 feet high; likewise the caves and caverns so common in this formation, where often whole rivers disappear in the bowels of the earth, in some cases to reappear again many miles distant. In some parts of the country periodical lakes are formed by these rivers, owing to an insufficient outlet for the water through the caverns during the rainy season.

The rivers Bosna, Vrbas, Sanna, and Unna all gush out from the earth as large streams.

The valleys often widen out into plains of considerable extent, offering a fertile field of alluvial soil to the agriculturist.

The river system is much cut up and divided by plateaux having an altitude sometimes in Bosnia of 3000 feet. In the district of Nova-Bazar, which, though no longer politically, is yet ethnographically, part of Bosnia, there are plateaux of even 6000 feet, and the Dolomitic mass of the Dormitor in Montenegro, close to the south-eastern frontier of the Herzegovina, attains an extreme height of 7200 feet.

Although all the natural phenomena of the "Karst" formation are present in Bosnia and the Herzegovina, it must not be supposed that the country resembles the barren "Karst" of Istria. The greater part of the Bosnian mountains are covered with magnificent forest, for "Karst" is seldom bare rock by nature. It is the hand of man which renders it so. The forests are recklessly cut down so as to cultivate the shallow soil, or to feed the goats on the leaves of the trees towards the end of summer when other food fails, or it may be for the sake of the timber, and in a few years the scanty soil is washed away by the rain, and nothing remains but barren rock.


LOCH EARN
LOCH TUMMEL
LOCH TAY
LOCH RANNOCH
BATHYMETRICAL CHART
LOCHS TAY RANNOCH TUMMEL & EARN

The great watershed of the country extends from Serajevo, by Tarcin, to Sebenico in Dalmatia, separating the rivers which flow northwards to the Save from the Narenta, which empties itself into the Adriatic. South of this watershed—that is to say, the whole of the Herzegovina—is the "Karst," in its barren, rocky desolation, while to the north the mountains, with the exception of some wild, barren plateaux, where the rainfall disappears as through a sieve, are covered with luxuriant forests of pine, fir, beech, oak, etc.

In all folk-lore Bosnia is termed "the golden," from its rich beauty of vegetation compared to the poor sterile Herzegovina. There is little doubt, however, that time was when the Herzegovina was also in many parts richly wooded; but the forests have gradually disappeared under the axe, as in Istria and the Southern Tyrol, to supply the markets of Venice and the Levant with timber.

The Herzegovina, with its rugged white rocks of limestone, is said to bear a resemblance to the south of Spain, while Bosnia has been likened by travellers to Norway. In climate, also, Bosnia and the Herzegovina differ widely. The latter has an Italian clime, where grapes, olives, and other southern fruits ripen to perfection, while the former is intensely cold in winter, lying deep in snow for many weeks, and the summer, though fairly hot, is of short duration, only the more northern fruits, such as apples, pears, and plums, being grown with success.

Until Austria occupied the country in 1878, these provinces were as Oriental in the appearance of their towns and in the habits of their population as many parts of Asia Minor. The Osmanli population could always be counted by hundreds, but the Mohammedans—renegade Slavs who had adopted the manners and customs of their conquerors—numbered about 48 per cent. of the whole population, and were largely in the majority in all the towns. It is a common error to talk of the Mohammedans in these provinces as Turks, but in reality the whole population, whether Mussulman, Greek-Orthodox, or Roman Catholic, are one and the same race—Slavs—but as antagonistic, owing to the difference of their religion, as though they were distinct nations. They are absolutely of the same kith and kin, and the same family names are still borne by Mussulmans and Christians alike, only the former, when they became converts to the religion of their conquerors so as to retain their lands and property, assimilated also their names. For instance, the Christian name Rajkovic, from "Raj," heaven, was changed to Djenetic, from the Turkish word "Djenet," heaven; Sokolovic, from "Sokol," a falcon, was changed to Shahinagic, from the Turkish "Shahin," a falcon. Numberless other such examples could be cited. In Bosnia and the Herzegovina, as throughout the East, it is religion alone which determines the political grouping of the people.

Bosnia and the Herzegovina have a superficial area of about 21,000 square miles, of which 9650 are covered with forest or brushwood, 6950 are arable land, and the remaining 4400 barren rock.

According to the census of 1885 the population was 1,336,000, of which 705,000 were males, and 631,000 females. 493,000 were of the Mussulman religion; 571,000 of the Orthodox-Greek Church; 266,000

were Roman Catholics; and 5,800 Jews. 25,300 Austro-Hungarian subjects, and 2,200 subjects of other foreign states, were settled in the country. The Jews, like their co-religionists throughout the Levant, are Spaniards, whose ancestors were driven out of Spain in the time of Ferdinand and Isabella, and the language still spoken by them is Spanish.

Bosnia was occupied by Croatians and Servians in the end of the sixth, and during the seventh, century, and from that time dates the antagonism, which still exists, between these cognate nations. The Croatians were the first settlers. In the ninth century they embraced Christianity, and became Roman Catholics, while the Servians adopted the Eastern-Orthodox religion and the Cyrillic writing. The respective use of the Roman and the Cyrillic character in their writings is even at the present day regarded almost as a tenet of their belief. The Croatians in Bosnia were governed by a "Ban," and the Servians by a "Zupan," but during part of the twelfth century the Croatians affiliated themselves to Hungary.

From the end of the fourteenth century until the Turkish invasion Bosnia had its own king. Since 1463 Bosnia, and since 1483 the Herzegovina, have been completely under Turkish rule. Under Sultan Mohammed II., in 1463, King Stepan Tomasevic was executed, 100,000 Christians were sent into slavery in Asia Minor, and 30,000 of the youth of the land were enrolled in the Janissaries. The Turkish conquerors found in Bosnia and the Herzegovina a feudal state, in which the nobility and clergy were the sole owners of the soil. As by Turkish law all land became the property of the conqueror, and only Mohammedans could be landowners, the Bosnian nobility would have been ruined had they not adopted the religion of their conquerors, and thus retained their estates. These nobles are the "Begs" of the present day, in whose hands is still the greater part of the land. The church property was likewise handed over to the Mussulman priesthood, and became "Vakuf." The peasants, who had little either to gain or to lose by a change of their religion, adhered to their respective faiths, and became the serfs of the Mohammedan landowners. These latter, in very few generations, broke all bonds of brotherhood with their Christian fellow-countrymen, and even surpassed their conquerors in tyranny and fanaticism.

Bosnia is the only southern Slav state which has preserved its feudal nobility. Servia, Bulgaria, and Montenegro freed themselves from the Turkish yoke, and formed democratic states.

Bosnia after the conquest became a terror to its neighbours, the Begs and Agas carrying their raids with fire and sword into the neighbouring states of Styria and Hungary. The province furnished up to the present century some 15,000 Janissaries, who were reckoned amongst the best troops of the Ottoman army.

After the siege of Vienna by the Turks in 1683—the commencement of the fall of the Ottoman power in Europe—Bosnia came into direct contact with Austria, and in 1694 Prince Eugene, who by a succession of brilliant victories had advanced the frontiers of Austria to the Save, appeared before Serajevo, after his famous nine days' march, to break the

power of the Bosnian nobles. By the Peace of Karlovitz in 1699 the frontier between Hungary and Turkey was regulated, and to Austria was conceded the protection of the Roman Catholics in Turkey; but during a century of strife the advantages obtained by Prince Eugene were gradually lost through the weakness of his successors, and finally in 1791, by the Treaty of Sistowa the Bosnian possessions again reverted to the Turks.

The history of Bosnia during the present century has been little else than the promulgation by the Porte of a series of reforms, rarely put into execution; but as the tendency of these reforms was more or less to place the Christians on an equality with their Mohammedan fellow-countrymen, to mitigate the feudal system, and to enforce the payment of taxes by the Mohammedans, violent opposition was encountered on the part of the Bosnian nobility, which, in the years 1831, 1837, and 1849 culminated in open insurrection. The last of these insurrections was put down with an iron hand by the Serdar Ekrem Omer Pasha, an Austrian renegade named Michael Lattas, who had formerly been a non-commissioned officer in a Croatian frontier regiment. He subjugated the Bosnian nobility, began to make roads, took a census of the population, and, above all, regulated the relations between landowner and peasant (Aga and Kmet) by the law of the 12th Sefer 1858, in a sense favourable to the latter. This law, now for the first time impartially carried out, is the one still in force under an Austrian administration, and gives, upon the whole, mutual satisfaction both to Aga and Kmet. Had Omer Pasha been left longer in the country it might have gradually advanced in the path of progress and civilisation under his impartial and energetic rule, but his successors allowed matters to fall back into the old groove, and the consequences were a renewal of the former antagonism between Mussulmans and Christians, partial insurrections of the latter, favoured and abetted by neighbouring states, and a gradual waning of the Ottoman power, until finally, to put an end to this unsatisfactory and troubled state of affairs, Austria-Hungary received the mandate at the Congress of Berlin in 1878 to occupy and administer Bosnia and the Herzegovina. This occupation was only effected after considerable bloodshed, as the Mohammedans, who, as soon as the Austrian forces crossed the frontier rose against their Ottoman rulers, murdering them, and expelling them from the country, offered a stubborn, but futile, resistance; but now at last, after centuries of misrule and disturbance, these provinces, so favoured by nature, are experiencing the benefits and repose of impartial, strong, and civilised government.

EXAMINATION SCHEME OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Examination was held on Saturday, March 3d, at Edinburgh, Dundee, Aberdeen, Nairn, Addiewell and Gersa.

Copies of the Examination Paper were sent from Edinburgh, and the examination at each centre was superintended by members of the Society.

The following syllabus was issued by the Committee some months before the examination :—

1. *Form and Size of the Earth. Day and Night. Time. The Seasons. The Mariner's Compass. Latitude and Longitude.*
2. *The Meaning of Terms used in describing the features of the Land (with Rivers and Mountains) and of the Sea.*
3. *The Meaning of a Map, and the representation of Land and Sea features thereon.**
4. *The Drawing of a small Sketch Map from description given.†*

* Reference should be made to the Ordnance Survey Map of the district in which the school is situated.

† Reference may be made to the introductory chapter of Keith Johnston's *Physical and Descriptive Geography*.

The Examination Paper, prepared by Professor Geikie and Mr. Grant Ogilvie, was as follows :—

Time allowed—Two hours.

1. The mouth of the Gaboon River and the mouth of the Amazon are both on the Equator ; the former is in Longitude 10° East, the latter in Longitude 50° West. How many miles apart are they ?

2. For what parts of the Earth is the Sun directly overhead at mid-day on at least one day in the year? For what parts is the Sun ever invisible for 24 hours, or more, continuously ?

3. When it was 6 A.M. this morning at Greenwich, what o'clock was it at Philadelphia (Lat. 40° N., Long. 75° W.) and what o'clock at Melbourne (Lat. 38° S., Long. 145° E.)?

4. Why is it warmer here in Summer than in Winter ?

5. In what direction does the Compass-needle point in Scotland ?

The following four questions (6, 7, 8, *and* 9) *refer to the Island shown on the map accompanying this paper*[1] :—

6. Describe fully the course of the Livingstone River.

7. State approximately the distance from Columbus to Franklin (*a*) "as the crow flies," (*b*) by the road by Burnfoot Mains, (*c*) by the road by Cape Newton. Give any reasons for preferring the Cape Newton Road to that by Burnfoot Mains.

8. If the level of the sea rose 100 feet, what would be the effect of this on the geography of the island ? Refer in your answer (*a*) to outline, (*b*) to rivers.

9. Describe shortly the Humboldt Plateau, Marco Polo Range, and Mount Ritter as they would be if the sea-level rose 1500 feet.

10. Make a sketch-map from the following notes—scale 200 paces to 1 inch. A scale of inches is given below, and may be detached for use in drawing the map.

From a certain point where four roads met, I observed that these bore respectively N., WNW., SW., and E., and that the bearing of a distant church spire was NE. I went along the East road, and at a distance of 100 paces crossed a bridge over a stream which came from NNW., and, after passing the bridge, flowed due South for some distance, and then turned westwards. At 50 paces beyond the bridge I found myself in line with the further part of the stream, which was in a direction SSW. At 100 paces from the bridge, being 200 from the cross roads, a road led due North, and passed the East side of the

[1] See Map issued with this number of the *Magazine*.

church ; a wood bordered the East side of the church road, from this point also a road led SE. along the West side of a wood to a farm. At this corner the main road bent to ENE., and I continued my walk along it, between the two woods. These woods I found to be 150 paces long, the further edge of the North one being N. by W., that of the South one bearing SW., and the farm already mentioned being due south of the point where the road emerged from the woods.

RESULTS.

The total number of candidates examined was 204, from 10 schools. Of these candidates 39 gained 75 per cent. of marks and upwards ; 86 gained between 75 and 50 per cent. ; and 79 gained under 50 per cent.

I. The following 18 candidates, having gained 80 per cent. of marks and upwards in the examination, received First Class Certificates and Prizes :—

		Per cent.
1	John C. Fyfe, Robert Gordon's College, Aberdeen,	95
2	R. Somerville, George Heriot's Hospital School, Edinburgh,	94
3	G. C. Allan, R. Gordon's Coll.,	92
4	A. Bennet, Geo. Heriot's Sch.,	91
5	A. W. Russell, do.	89
6	T. C. Bailie, do.	87
	A. J. Turner, do.	87
	John Middleton, do.	87
	Joseph G. Alexander, Robert Gordon's College,	87
7	G. A. Pirie, Gordon's Col.,	86
8	W. Thomson, George Heriot's School,	85
9	George W. Walker, Robert Gordon's College,	83
	J. S. Benson, do.	83
10	G. Wilson, do.	82
	Alexander Henry, do.	82
11	J. Collier, Nairn Academy,	81
12	William Low, Robert Gordon's College,	80
	H. W. Wood, do.,	80

II. The following 21 candidates, having gained 75 per cent. of marks and upwards, received First Class Certificates :—

From Robert Gordon's College, Aberdeen.

	Per cent.		Per cent.
J. E. Esselmont,	79	John Stott,	77
James Garden,	78	Edwin Wigglesworth,	76
Adam G. Murray,	78	James M. Watt,	76
John C. Watson,	78	W. Cruickshank,	76
John G. Benzie,	78	W. Robertson,	76
Berry Tait,	77	James Pirie,	75

From George Heriot's Hospital School, Edinburgh.

	Per cent.		Per cent.
Henry Herd,	78	A. Mackenzie,	75
Henry R. Carr,	78	Duncan Brown,	75
Andrew Younger,	78	W. Simpson,	75
A. J. Bertram,	77		

From Merchiston Castle School, Edinburgh.

G. W. Hutchison, 77 per cent.

From St. George's Hall, Edinburgh.

J. M. Church Little, 77 per cent.

III. The following 86 candidates, having gained from 50 to 75 per cent. of marks, received Second Class Certificates :—

From Robert Gordon's College, Aberdeen.

Allan, Robert J.
Bowie, James.
Brebner, Frank.
Cattanach, D.
Cheyne, George.
Fraser, Henry.
Fraser, Thomas.
Gibson, A. M.
Gordon, Alexander.
Gray, Francis W.
Gray, Henry.
Hall, John F.
Laing, James.
Mackie, John.
Murray, David.
Nicol, John.
Pickford, James.
Rattray, George.
Rennie, George.
Ritchie, Charles.
Robertson, James W.
Rodger, Alexander.
Rodger, J. P.
Rodger, William.
Ross, David.
Ross, John A.
Skeen, Andrew.
Skene, John L.
Souter, Thomas W
Stephen, Thomas M.
Stewart, George.
Troup, George A.
Valentine, Leslie.
Walker, W. J. B.
Watt, Thomas.
Webster, William.
Wyness, James.

From George Heriot's Hospital School, Edinburgh.

Anderson, J. G.
Anderson, J.
Barrow, J.
Blacklock, J. F.
Clark, Duncan.
Davidson, R. T.
Govanlock, W. J.
Grierson, G. D.
Hardy, J. W.
Kirk, R.
Lindsay, W.
Mackay, G.
Minty, F. C.
Mitchell, J.
Oldham, M.
Scott, J.
Winlaw, G. A.
Woolard, W.

From High School, Dundee.

Air, David.
Anderson, C.
Bachelor, A.
Baxter, E.
Donaldson, D.
Hain, M.
Inglis, A.
Macleod, D.
Patullo, H. W.
Whytock, A.

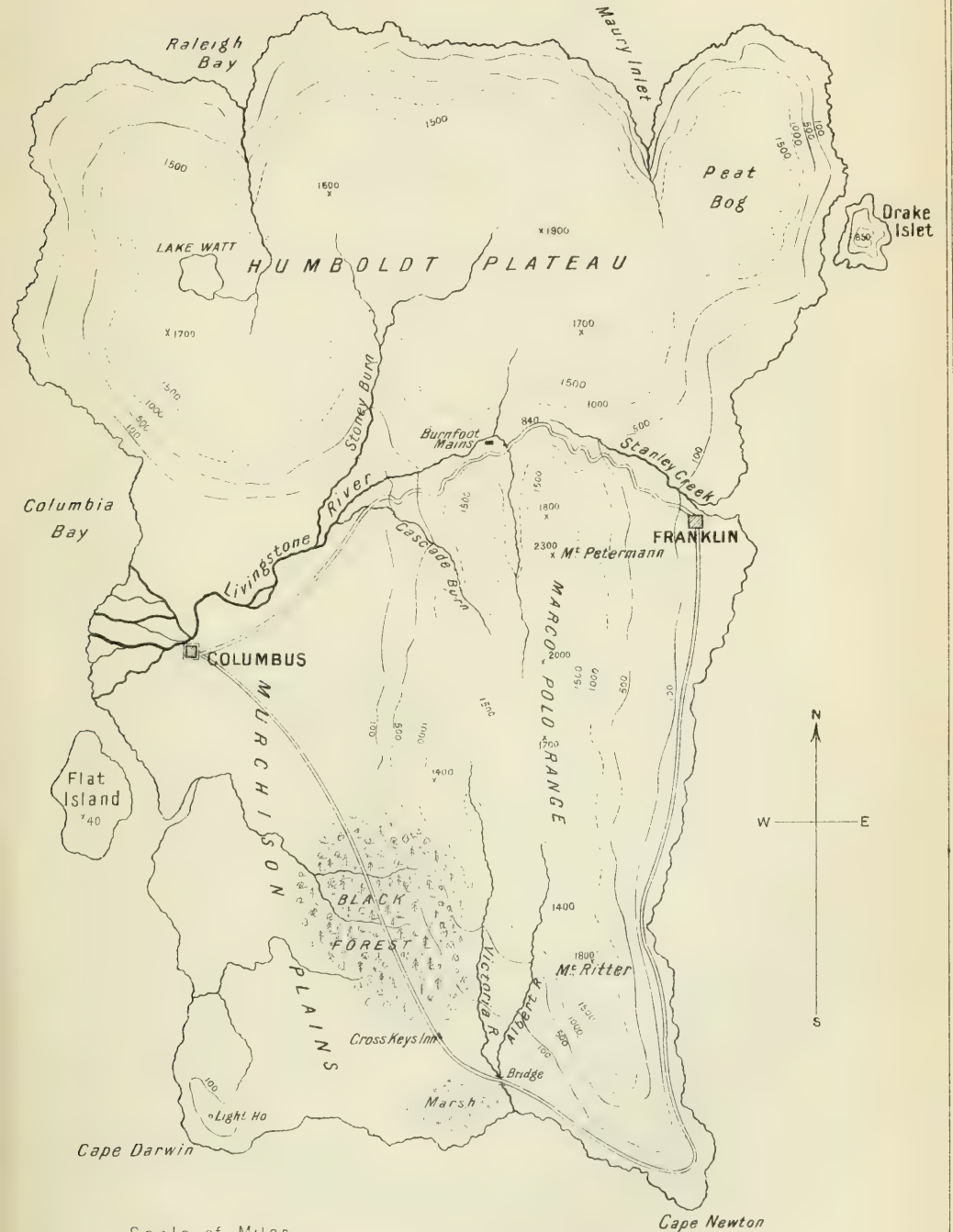
From St. George's Hall, Edinburgh.

Black, Jeanie A.
Hunter, Isobelle H.
Mackenzie, Rachael.
Macmillan, Mary.
Ross, Margaret.
Shiress, Isobel.
Stewart, Agnes Grainger.
Stewart, Alice Grainger.

From Merchiston Castle School, Edinburgh.

Lamb, J.
Lean, R.
M'Carthy, D.
Muir, W.
Strath, D.

MAP FOR EXAMINATION



J Bartholomew Edin.

Royal Scottish Geographical Society, 1888.

From Nairn Academy.

Cameron, W. T.
Farquhar, H.
Macbain, A. W.
Mackintosh, H.
Penny, W.

From Addiewell School.

Martin, M.
Rennie, W.

From East Calder School

MacGregor, C.

From Canongate School, Edinburgh.

Neilson, J.

The Atlases and Books awarded as Prizes were presented to the Committee by the following firms :—

Messrs. W. & A. K. Johnston.
Messrs. Thomas Nelson & Sons.
Messrs. A. & C. Black.
Mr. John Bartholomew.

The Committee is further indebted to Mr. Bartholomew for the Certificate forms.

The following is the Report of the Examiners on the whole Examination and the results :—

Edinburgh, April 12, 1888.

Dear Sir,—Herewith we send you the results of the Examination in Geography which we were asked to conduct on behalf of the Society.

We much regret that a larger number of schools should not have been represented. It is possible, however, that many teachers may not have heard of the Society's scheme, and in the event of a similar examination being held next year every means should be taken to give the matter the widest publicity. Probably, also a number may have held back from doubt as to the scope of the examination and the kind of paper likely to be set. A first trial under a new scheme must always be tentative, and it would not have surprised us had the failures been more numerous than we have found them. Teachers will see from our paper, which we understand is to appear in the pages of the Society's Magazine, that what is wanted from Candidates is not a mere list of place-names, but real knowledge of the ground-work of scientific geography. The excellent appearance made by a large number of the candidates in the present examination is extremely interesting and gratifying, inasmuch as it shows that a thoroughly accurate and scientific basis for geographical study can be laid at school. To be able to read with ease maps drawn to any scale, and to form from them an adequate conception of the physical aspects of the lands depicted are essential preliminaries to all real work in geography.—We are, dear Sir, yours faithfully,

James Geikie, LL.D., F.R.S.
F. Grant Ogilvie, M.A., F.R.S.E.

W. Scott Dalgleish, Esq., M.A.,
Convener of the Education Committee
of the Royal Scottish Geographical Society.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Society held a meeting in Edinburgh on Monday, the 2nd April, to hear the Report of Mr. Henry O. Forbes, on his return from New Guinea. The chair was occupied by Colonel Dods, and there was a large attendance of members. Mr. Will. C. Smith moved, and Dr. John Murray seconded, a vote of thanks to Mr. Forbes. After the Paper, a series of views was shown by the lime-light lantern, and Mr. Forbes exhibited a portion of his collections.

On the following evening, Mr. Forbes repeated his address, with the lime-light exhibition, before the Glasgow Branch of the Society. Dr. W. G. Blackie, who presided, moved the vote of thanks.

Mr. Forbes addressed the Aberdeen Branch of the Society on the evening of 10th April. Mr. Ferguson, of Kinmundy, presided, and moved the vote of thanks to the lecturer.

The Dundee Branch of the Society held a meeting on the 13th April—Mr. John Robertson, of Elmslea, presiding—when Mr. H. O. Forbes re-delivered his address on New Guinea. Professor D'Arcy Thompson moved the vote of thanks to the lecturer.

At the above meetings of the Branches, Mr. Forbes exhibited his collections, and illustrated his address by lime-light views.

DIPLOMAS OF FELLOWSHIP.

The Council, at its sitting on 23d March last, granted the Diploma of Fellowship to the following Ordinary Members of the Society :—

Francis Black, Esq., F.R.G.S.; Lieut.-Colonel H. Burnley-Campbell of Ballimore; and Robert Mason, Esq., F.L.S.

GEOGRAPHICAL NOTES.

EUROPE.

A Submerged Forest.—During the late violent storms in the Channel, the sea washed through a high and hard sand-bank near St. Malo, nearly four mètres thick, laying bare a portion of an ancient forest which was already passing into the condition of coal. This forest, at the beginning of our era, covered an extensive tract of the coast; but with the sinking of the land it became submerged, and covered up by the drifting sand. Mont Saint Michel once stood in the middle of it. The forest had quite disappeared by the middle of the tenth century. Occasionally, at very low tides after storms, remains of it are disclosed, just as at present. It is believed that some centuries ago the highest tides rose about twelve mètres above the level of the lowest ebb. Now, the high-water level is 15·5 mètres above the lowest.—*Times*, April 3, 1888.

Arctic Regions: Weather and Distribution of Ice.—On the state of the weather and the distribution of ice last summer in the Arctic Ocean to the north of Europe some observations are noted in *Deutsche Geographische Blätter* (Band x., Heft 4)—the organ of the Bremen Geographical Society. There was a great deal of ice last July to the north of Norway and around Spitzbergen, whilst the sea towards Novaia Zemlia (Nova Zembla) was open. Strong NW. winds and thick fogs in August put an end to the whale-fishing off the Norwegian coasts a month earlier than usual. At the same time there was evidence to show a heavy

drifting of ice in the NNW. The weather and ice conditions round Iceland were unusual. The whole northern coast to North Cape (Iceland) was, even in July, shut in by a girdle of ice 20 nautical miles in breadth. The steamer *Thyra*, in the first half of August, was forced to turn back in consequence of the masses of drift-ice she encountered ; she reached the east coast of Iceland on 16th August, but could not push further north. Only the Beru Fjord, on the east coast, was open, but it also filled with ice, and the *Thyra* had difficulty in working her way out. About the same time the steamer *Laura* safely reached the Eski Fjord, on the west coast, but was unable to penetrate to the Seydis Fjord, on the north-east coast, in consequence of the heavy drift-ice off North Cape (Iceland). On 6th September the Seydis Fjord was free from ice, but large ice-fields drifted between this fjord and the Eski Fjord. Between the 7th and 10th September a severe storm of wind from the NNW., accompanied by a heavy snow-fall, prevailed over the whole island ; it was especially severe on the east coast. It is commonly supposed in Iceland that if the north coast is not free from ice by the end of August it remains the whole winter—as was, in fact, the case last year. The weather in the Faroe Islands was very stormy in August and September—N. and E. winds, with fogs, prevailed. On the east coast of Greenland, according to the scanty reports to hand, the ice seems to have been piled up to a considerable extent. The prevailing E. and NE. winds drove the ice from the region to the north of Spitzbergen and Novaia Zemlia towards the northern shores of Norway, Jan Mayen, Iceland, the Faroes, and the east coast of Greenland. According to the reports of the Norwegian whalers, the regions north and east of Novaia Zemlia must have been free from ice, and Franz Joseph Land could again have been easily reached last summer. It was, perhaps, on this account that Captain Wiggins was able to reach the mouth of the Yenesei from Vardö, by way of the Kara Sea, where he arrived in the middle of October.

ASIA.

New Siberian Islands and Yana District.—Herr Wichmann contributes to *Petermann's Mitteilungen* (ii. 1888) a report of the expedition under Dr. Bunge and Baron Toll, during 1885-86, to the New Siberian Islands and the district of the Yana, on the mainland. When the two travellers left Verkhoiansk (which, by the way, Dr. Buchan states is the coldest spot in the world) the district of the Yana, which they intended to explore, was one of the least known in Eastern Siberia. They descended the river Yana in August of 1885. Snow began to fall as early as August 11th, and the travellers spent the winter at Kasatshié, on the Lower Yana, making excursions in the neighbourhood. In the month of April 1886, they left Svétoï Noss, where provisions had been collected, and started for the New Siberian Islands. We have already referred (vol. iii. page 480) to their work on the islands. A good map in *Petermann* illustrates the exploration.

Thian Shan Mountains.—The expedition under Messrs. Ignatieff and Krassnoff to the Thian Shan mountains, and the culminating group of the Chan Tengri, has achieved important results in the exploration of the vegetation and topography of the region (see *Isvestiya*, No. 2, 1887, of the Russian Geographical Society. The Semenoff glacier was found to be at least 10 versts (10·5 *km.*) in length ; its daily advance was estimated at 53 *cm.* at its foot and at 1 *m.* at the centre. The Musart Pass lies at an altitude of 12,240 ft.

The Khinghan Mountains.—In 1887, M. Garnak, a Russian traveller, made a journey from Pekin to the banks of the Argun, in the region of the Khinghan Mountains (Amoorskaya). He traversed this fine chain of mountains four times

from the west to the east, and followed almost its entire length from south to north. Leaving Kalgan, he first went to Dolon-nor, from whence he penetrated the *massif* of Khinghan in order to cross it for the first time. Then he returned to the plateau of Eastern Mongolia, and struck a route along it parallel to the Khinghan, as far as Dalaï-nor. From the convent of the Darkhan-Sumé *lamas*, M. Garnak again turned east and crossed the Khinghan for the third time, and followed their eastern slope to the country of the Solons and Dahurs, who are indefatigable hunters and soldiers of the Chinese army. The country there is mountainous and covered with immense forests; in spite of these and other difficulties, however, M. Garnak forced his way towards the central ridge of the Khinghan in order to cross it for the fourth time. He arrived at the small village of Khaïlar, and from thence proceeded to the Trans-Baikal province of Siberia.

M. Ressine, another Russian traveller, has visited much the same region of Eastern Asia. He came out of China through Mongolia, and explored the basin of the Upper Liao-hé and the desert extending between this river and the Nonni-ula, on the eastern slope of the Khinghan. Then he continued his journey to Tzitzikar and Aïgun.—M. Venukoff in *Compte Rendu* (No. 5, 1888) of the Paris Geographical Society.

The Andaman Cannibals in Chinese Literature.—To the *Journal* of the China Branch of the Royal Asiatic Society (Nos. 1 and 2, 1887) Dr. F. Hirth, the President, contributes the following note:—During the Middle Ages the Andaman Islanders were spoken of by Arab navigators with superstitious fear. As early as the middle of the ninth century the Arab travellers, known by the translation of their accounts furnished by Renaudot and Reinaud, report that "these people devour men alive; their hue is black, their hair woolly; their countenances and eyes have something frightful in them; their feet are of enormous size; they go naked, and have no boots." A number of passages, chiefly from western authors, as given by Yule and Burnell in their Anglo-Indian Glossary, report to the same effect. To these I should like to add what Chao Ju-kua has to say on the Andaman Islands in the beginning of the thirteenth century.

"When sailing from Lau-wu-li [*i.e.* the island of Lambri, in the north-west of Sumatra] to Hsi-lan [Ceylon], if the wind is not fair, ships may be driven to a place called An-to-man (Andaman). This is a group of two islands in the middle of the sea, one of them being large, the other small; the last is uninhabited, whereas the large one, measuring 70 li in circuit, is. The natives are of a colour resembling black lacquer, and eat men alive, so that sailors dare not to anchor on this coast. This island does not contain as much as an inch of iron, for which reason the natives use clam-shells with ground edges in lieu of knives. The island contains as a sacred relic the so-called 'Dead Man received in the Bed of Rolling Gold;' this body has been there for generations without decaying, and there is always a huge snake guarding it, on whose body hair has grown to the length of two Chinese feet; nobody dares to come near it. In the vicinity there is a spring the water of which will overflow twice a year and flow into the sea; the gravel over which it passes, after it has been covered by this water, turns into gold, and all the natives offer sacrifice to that spring. If copper, lead, iron or tin is soaked with this water while in a state of red-heat, it will also be changed into gold. There is an old story told of a merchant's ship which got wrecked, and the sailors of which drifted on a bamboo raft to this island. As they had heard about this sacred water, they secretly filled some of

it into bamboo tubes, mounted a wooden raft, and were driven by the current of the sea to the country of Nan-p'i (which, from the author's detailed description, I identify with the coast of Malabar), where they presented the water to the king of that country. On having tried its effects the king of Nan-p'i raised an army for the purpose of gaining possession of that island; however, before his fleet could arrive there, they met with a severe whirlstorm, and the ships with all on board were thrown on shore at this island, and all the men were eaten up by he islanders. For, on this island live the 'Strangers of the Golden Bed,' which s silently guarded by a spirit so that man may not come near the place." It is very probable that our author, who lived at Chinchew as Superintendent of Foreign Trade, got in the possession of this piece of island-lore through the Arab merchants trading to Zaitun, and that the account, as handed down by him, represents what was then currently reported among the travellers of the Indian Ocean. According to Conti (*India in the Fifteenth Century*, quoted by Yule and Burnell, *l.c.*), the name Andaman means "the Island of Gold," and the tale of the "Body in the Bed of Rolling Gold," and the unlucky exploit of the Malabar fleet may be connected therewith.

British North Borneo.—From the plan of the Segama made by Captain R. D. Beeston during his late expedition, it was hoped that a nearer road could be obtained *viâ* Madai Hill and the Batturong Bird's-nest caves, and accordingly a party under a Mandore from the Survey department, and including a Dyak who had accompanied Captain Beeston up the Segama, were despatched with instructions to follow a fixed line. The party returned by the s.s. *Paknam* on the 28th January. It would appear that after proceeding about 10 miles in a WNW. direction for three days, their hearts failed them, and they returned, first making a detour to the north and then east, when they met a large stream which proved to be the Ting Kyo. They made two bark boats and descended. This is a proof that the stream is a navigable one, and a further exploration on this side may be productive of good; but those who know Darvel Bay say that a very high range of hills, probably over 5,000 feet, is to be seen to the west of Madai Hill, which also accounts for the unexpected size of the Ting Kyo river.—*The British North Borneo Herald*, February 1, 1888.

AFRICA.

The Canary Islands.—Dr. Verneau, at a recent meeting of the Paris Geographical Society, gave an account of five years' scientific research in the Canary archipelago, an abstract of which is given in the *Compte Rendu*, No. 4, 1888. The seven islands and the islets, which are almost entirely of volcanic origin, present to the view a series of mountains and volcanoes, which attain, in the peak of Teneriffe, the height of 3711 mètres. Here huge monoliths, there lava streams, stretch to the water's edge. Everywhere there are deep ravines, sheer precipices riddled with caves, the almost vertical sides of which sometimes measure 1000 mètres in elevation. These caves were used by the aboriginal inhabitants as cemeteries. The history of these people Dr. Verneau has reconstructed; the perilous task of reaching the caves he made his frequent duty. In some of the islands there are no springs; and rain-water is the only water to be had, and that only in extremely small quantities. In the districts where there is water, the fertility of the soil is extraordinary. The traces of immense forests are still to be found; they contained laurels 30 metres high, the ilex, and the gigantic pine of the Canaries. According to the altitude, one meets with the flora of Europe, Asia, Africa, America, and Oceania. The fauna is

poor: the mammalia comprise almost only domestic animals; the birds, among which we may mention the canary, are more abundant. Lizards, grasshoppers, bugs, mosquitoes, and all parasites abound. The present inhabitants of the country are descended from the aboriginals and all the races who have touched the islands. They have preserved a certain number of physical characteristics, and a great number of customs in their descent. One of the most curious is the whistling language of the Gomera people, who thus converse at great distances. Dr. Verneau showed that the Canary archipelago had been peopled, at the first, by people possessed of great stature, long necks, and large but mean faces. These Guanches he makes descend from our predecessors of the quaternary epoch, to whom they present considerable analogy. Later, the Numidians, who have left traces of their passage in the inscriptions on the rocks, visited the islands. Others followed them, notably the Semites, who, in crossing with the Guanches, have in certain localities entirely altered the primitive type.

African Coast between Mogador and Cape Juby.—Dr. Jannasch, President of the "Association of Commercial Geography and the Promotion of German Interests Abroad," led a commercial expedition to Marocco, during 1886, to explore the coast between Mogador, in Marocco, and the steppe country round Cape Juby. A report of this expedition is given in *Annalen der Hydrographie*, Heft II., 1888. One of its chief objects was to discover a good port on the coast where European goods could be exchanged with the produce of the territories between the Atlas and Anti-Atlas, and the lands lying to the south and south-west. Two of the expedition were drowned by the capsizing of the ship's boat off the mouth of the Wad Schwika, SW. of Cape Nun, where a landing was attempted; the remainder were unable, therefore, to return to the ship, which lay off at a considerable distance. The shipwrecked expedition, under the leadership of Dr. Jannasch, suffered great privations on the inhospitable coast. They were plundered and treated badly at one place; but eventually they reached Glimim, the chief town of the Wad Nun,[1] and the residence of the Kaid Dachman Ben Biruk. The latter received them well, and sent them with an escort to the Sultan of Marocco, who was engaged in a campaign in the southern part of his dominions. The Sultan forwarded them to Mogador, where they again met their ship, and went on board.

Dr. Jannasch has published an account of the expedition (*Die deutsche Handelsexpedition*, 1886), and expresses his views on the trade and commerce of Marocco, and on the political and commercial conditions of the empire and the steppe lands lying to the south. The political state of Wad Sus, Wad Nun, and Wad Draa, in regard to which very erroneous (though scanty) ideas prevail, is treated at length. His descriptions of the country and people are admirable and of permanent value. He points out several errors in our charts and *Pilots*, and gives valuable information in regard to the rivulets (Wads) flowing into the sea to the south of the Anti-Atlas. The majority of these Wads are river valleys similar in character to the greater number of West African rivers; all those crossed by the expedition were forded. Only when the snow on the heights of the Anti-Atlas was melting did the Wads assume the character of a river in their lower course. A valuable original map of the coast (between 28 and 31 degrees of latitude) accompanies the book.

Emin Pasha.—Letters from Emin Pasha (the latest, dated Wadelai, September 3d, 1887), reached this country on 9th April last. Those to Dr. Robert W.

[1] Same name as the river.—EDS.

Felkin are among the most important yet received. The first letter (15th August 1887), contains the following passage :—"I must beg you to fulfil for me one duty—namely, to express in my name to the Council of the Scottish Geographical Society my feelings of the deepest gratitude for the warm and hearty manner in which they took up my cause, notwithstanding that I was a perfect stranger to them. The expression of the sympathy of such men for me as the last pioneer of civilisation and progress, as a worker for the emancipation and welfare of the Negroes, can only have one effect—namely, that of urging me more strongly than ever to hold on to my post, and of encouraging me to proceed in the course I have so long pursued. Will you assure the gentlemen from me that, as long as God spares my life, I will remain at my post, and will strive to uphold the traditions I received from Gordon?" As regards the future, Emin Pasha says :—"It is impossible to think in earnest of giving up the ground we still possess ; there can really be no question about it. It was only on account of the pressure of circumstances that I was compelled to give up for a time the outlying districts, such as Monbuttu, Rohl, and Latuka. It was a sacrifice that I made most unwillingly, and only on account of the absolute necessity of the case. As soon as I am in a position to do so, I shall most decidedly reoccupy the western districts in order to prevent their falling into the hands of any one else. The easterly districts, such as Latuka and Farchel, can be occupied at any moment. The stations which we at present occupy are Rejaf, Beden, Kiri, Muggi, Labore, Khor Aju, Dufilé, Fatiko, Wadelai ; and in addition to these, I have reoccupied Wandi, in Makraka, and Fadibek. I have also the two stations of Little and Great Mahagi, on the Albert Lake. Lado I have given up, partly because the district has been left by the Negroes, and partly because it was so difficult to supply the garrison with food. Three days ago I sent off a small exploring party from here towards the south-west ; they have orders to try and find Mr. Stanley, and also to seek for a suitable place for erecting a new station in the A-Lendu district. With regard to a future route for obtaining supplies, I have in my mind two—the one follows the western shore of the Albert Lake, then passes obliquely through Mboga and the district of the Baltua(?) to the northern extremity of Tanganyika ; the other goes in a westerly direction to the Welle-Makua. But it remains to be seen which I shall choose, and I must wait until I know the result of Stanley's expedition before deciding. Without doubt, however, the best and only route for us eventually is, not one to Tanganyika or to the west, but through the Lango and Masai districts to the coast. Even Mr. Stanley will probably find that the difficulties of the Congo route are almost insurmountable, especially those of transport. I know the almost impassable swamps, the numbers of rivers with floating vegetation, from personal observation, and I know well enough the difficulties which a traveller will have to surmount in marching from the Congo here. On the other hand, I cannot think that England, who has obtained a sphere of influence between Mombasa and our countries, will intend to let the district lie fallow. Surely she will be far more likely to utilise it. Sooner or later, therefore, it will be absolutely necessary for stations to be erected, in order to permit merchants to traverse the country in safety, and also for the purpose of regulating the transport. And the presence of camels, both in the Lango and Masai districts, offers every possible help to such a project. We can take it for granted, then, that the opening up of this route is only a question of time, and if I live until England commences to open up a road from the coast, I can easily concentrate a few troops, found a few stations, and therefore be able soon to join hands with those coming from the east, and help them considerably. However, it is no good trying to do this now ; I must

wait until Mr. Stanley arrives, for he will probably bring me a key to all these riddles." Further on he says that he had, at the time of writing, received no instructions from Egypt in regard to the future administration of the province, and continues :—"Now, whatever instructions I receive from Egypt, one thing is clear, that it is impossible for me, with all my people, to evacuate this province. We shall therefore have to see whether the Egyptian Government intends to relinquish all claims to the province, which, at the present time, is perfectly useless to her, or whether she intends to retain it and to become responsible for the cost of its retention or not. The newspapers which Mr. Mackay has had the goodness to send me only give me news to November 1886, and therefore it is impossible for me to form any opinion as to the state of affairs in Egypt, and whether they have any intention of reoccupying the Sudan again or not. If, however, we take it for granted that the Egyptian Government intends to relinquish this province ; and that, on the other hand, England is compelled, owing to political circumstances, not to annex these districts, then comes the question which you have raised—for me to take up an independent position just as the Rajah of Sarawak has done ; that it will be perfectly possible for me to do this is certain, and I am glad that you think so too." Having received several caravans, through the generous agency of Mr. Mackay, of the Uganda mission, Emin Pasha speaks in hopeful and contented terms of the position of the province. As regards trade, he says :—"In the east we have in abundance ivory, ostrich feathers, skins, oils, wax, tree butter ; and in the west, ivory, india, rubber, palm oil, furs, etc., certainly enough for trade." After speaking of the war between Uganda and Unyoro, Emin says :—"As England and Germany have at last arrived at a decision as to their various spheres of interest in East Africa, it is certainly time to think of how it is best to develop our countries ; and I consider that the first and most important resolution which must be come to, both for preserving peace and for the future welfare of Central Africa and the advance of its people, is an absolute veto on the introduction of guns, powder, and other munitions of war."

In his letter to Mr. Allen, dated Wadelai, August 16, 1887, Emin Pasha says :—"I have introduced order everywhere, and our native chiefs have been consulted. The crops for this year are, luckily, abundant. The cotton plantations yield very fairly, and altogether things now look brighter than before. By Mr. Mackay's kind help I have procured a considerable quantity of sheeting and prints from Uganda ; if not sufficient to satisfy our wishes, they were enough for giving to every one some little gift. But as our self-made 'damoor,' or cotton stuff, is more appropriate for wear and tear, we reserve these for holidays. The value of what they receive I make my men pay from their wages."

We have quoted from these letters at some length, because Emin Pasha, from his unique position, can scarcely fail in exercising a most important influence on the future of Central Africa.

The Country of the Garenganzé : Central Africa.—In the January number of *L'Afrique explorée et civilisée*, an account is given of the country of Garenganzé, compiled from letters sent home by a countryman of our own, Mr. F. S. Arnot, who has for the last two years been labouring as a missionary in that part of Central Africa. He reached that place from Benguela, on the West Coast, taking Bihé on his way, and spending some time with the American missionaries who are stationed there. In February 1886 he arrived at Mukurru, which lies to the west of the river Lufira, one of the largest affluents of the

Upper Lualaba. Moshidé, the chief, received him favourably, and authorised him to visit the country for the purpose of selecting a suitable locality to form the centre of his operations. He eventually gave the preference to the place where he had fixed his first encampment. This lay a little to the south of Mukurru, and about 100 miles westward from Lake Bangwéolo. It is thought to be almost equidistant from the East and West Coasts of Africa. Between Lake Bangwéolo and the river Lufira there is a chain of mountains, to the west of which the Lufira runs northwards as far as Lake Kassali. Garenganzé has for its western limit the river Lualaba, and is thus included within the Congo Independent State, whose southern frontier is determined by the region which contains the sources of the affluents of the great river, including those of the Lualaba and the Lufira. Arnot, soon after his arrival, learned that a Garenganzé caravan, which he had met on his way near the river Lumesé had been plundered by the people of Bihé, who had reduced to slavery all the men and women belonging to it. Another caravan which he had seen at Malangé had also been attacked. The commercial relations between Bihé and Mukurru had thus been very seriously disturbed, and Moshidé was taking steps for re-establishing the security of the trade routes.

The number of villages in the neighbourhood of Mukurru is considerable. In a two hours' excursion, Arnot counted no fewer than forty-three, all of great size, and surrounded by well-cultivated fields. Moshidé's own town is large, and, for Africa, populous. It is about eight miles in length, and lies in the plains through which flows the river Unkeya. Groups of huts lie scattered about in every direction. Here and there are central points where the king has houses of his own interspersed among those of his subjects. Peace and quiet reign everywhere. The king is greatly feared, for his rule is stern. Death is a common enough punishment for serious crimes; it is inflicted, however, without torture, and even expeditiously. Field labour is the penalty for minor offences. The time for digging the fields is the month of October, when most of the work is done by the men. With their industry, one might think these people would be well off for food all the year round; but such is not the case, for they use up a great quantity of barley in brewing a kind of strong beer, which they lose no time in consuming. Owing to the great superabundance of women, polygamy is prevalent, and in a disgraceful form. Marriages are not effected by purchase as in Zululand and elsewhere; nor do wife and children become the property of the father, as among the Ovimbundu, but when a girl is betrothed a present is made to her father, who still retains his authority over her. She is thus free to leave her husband whenever the fancy seizes her.

The soil is stony and sterile, although along the river margins it is sufficiently fertile. Maize ripens in three months after it has been sown. During the rains, vegetation is exceedingly rank and luxuriant. The atmosphere is remarkably clear and free from fogs. The heat is sometimes excessive, but never stifling. The climate altogether may be considered healthy. Game is abundant. Troops of wild animals of every sort, from the gazelle to the elephant, are to be seen roaming over the plains. Wild boars, leopards, and lions infest the environs of the villages. The neighbouring tribes suffer much from the incursions of the Garenganzé, who ravage their lands, carry off their wives and children for slaves, plunder them of their ivory, and take away the heads of the slain to exhibit as trophies. Their commerce with Bihé consists principally in slaves; while the Arabs, who come to the Lufira, carry away to the East Coast many slaves, whom they purchase from the Garenganzé. An Arab whom Arnot saw at Moshidé's house, told him that he had come from Mozambique and

crossed Lake Nyassa, where he had seen two steamers, and many Englishmen and one English lady. According to his account, Nyassa would be a two months' journey from Mukurru; the route was safe and provisions abundant. In his excursions Arnot has pushed northward as far as Kagoma on the Lukurruwé, a left-hand affluent of the Lufira; and to the south-east, as far as Kaunga, on the left bank of this last river. To arrive at Kagoma, Arnot had to traverse a country perfectly flat, rocky, and arid. The inhabitants cultivate barley, oil-yielding plants, and tobacco. At Kaunga the population was numerous, but apparently very poor—depending for subsistence on fishing far more than on the cultivation of the soil. Arnot has perhaps by this time been joined by two assistants, who were to start from Bihé for Garenganzé in the latter half of last year, and who expected to reach their destination after a three months' journey.

Lake Nyassa.—Consul O'Neill writes that he has obtained, on his recent journey, a good line of longitudes from Quilimane to the north end of the Nyassa Lake, which will show the lake to be placed too far to the west by from 6′ to 8′. The Rev. L. Scott, his companion, succeeded in making a good collection of plants. Mr. O'Neill hopes to send the astronomical and botanical results of the journey for publication in the Magazine.

Amatongaland.—The importance of this territory to Great Britain appears to be considerable, and it is now, by the treaty of friendship made between the Governor of Natal and the Amatonga chief, Zambila, practically included within the British sphere of influence in South Africa. Colonel W. Jesser Coope lately read a paper on the subject before the London Chamber of Commerce (see their *Journal*, 5th March 1888), in which he pointed out that the country has been so little visited by white men that its very name, Maputaland, seems to have been lost sight of, for the map-makers have styled it Amatongaland. "As a matter of fact," says Colonel Jesser Coope, "there is no such country as Amatongaland, no such people as the Amatonga. The term "Tonga," meaning a well-licked cur, is applied by the independent Maputas and Swazies to those Kaffirs who have lost their manhood under the Portuguese yoke through the combined influence of mean and depraved European habits." The main object of Colonel Coope's paper is to show the commercial and political importance of Amatongaland, and to suggest a method by which British commerce can discount the unfavourable influence of the Delagoa Bay Railway.

AMERICA.

Haïti, or San Domingo.—This little-visited island of the West Indies has been explored, chiefly in the interest of botany, by Baron Eggers, and a report of his journey is given by him in *Petermann's Mitteilungen*, II., 1888. Leaving Puerta Plata, the chief port of San Domingo on the north coast, Baron Eggers reached, by almost impassable paths, the valley between the Sierra de Monte Christi in the north, and the central chain, the Sierra del Cibao, in the south, which stretches across the island from the Bay de Samaná to the Bay of Manzanillo. He made a long stay at Santiago (8000 inhabitants), and then proceeded south to investigate the Sierra del Cibao. He ascended the Pico del Valle (2630 mètres), and made valuable observations.

Von den Steinen's Journey in Brazil.—*Deutsche Rundschau* (April 1888) publishes some more information in regard to the expedition of the brothers Karl and Wilhelm von den Steinen, who were accompanied by Dr. Ehrenreich and

Dr. Vogel. The object of their mission was the study of the Indian tribes at the sources of the Shingu (Xingu), who are wholly barbarous. The expedition, which left Germany more than a year ago, was detained on the Brazilian coast, but reached Cuyabá in July last. With ten men and twenty horses, the expedition, set out in August, and in one month reached, towards the north-east, the Kulifëu, an arm of the Shingu, where a camp was formed. The river was then navigated down-stream. Six Indian tribes were visited on its banks, five of which were hitherto unknown. In consequence of the rainy season setting in the expedition was forced to return, and reached Cuyabá again on 31st December.

Height of Mount Pan de Santa Ana, Peninsula of Paraguana, Venezuela.—According to information from Captain H. Leithäuser, of the steamer *Hungaria*, the height of this mountain is not 1302 ft., as given in the *West India Pilot*, and on the chart of the British Admiralty, but 2885 ft. The latter height was given by a Mr. Ludwig, who ascended the mountain and ascertained its height. —*Annalen der Hydrographie*, etc., Heft III., 1888.

AUSTRALASIA.

German New Guinea.—The *Nachrichten über Kaiser Wilhelms-Land u. der Bismarck-Archipel.* continues in Heft V. its report of the thorough and systematic work which the Berlin New Guinea Company is doing. A second map, well executed, of Huon Bay, gives the result of a further survey of its coasts, the northern side consisting mainly of fertile and well-watered slopes. The Markham River, which debouches at the head of the gulf, does not promise much for navigation, the stream being too rapid, and its average depth, as far as investigated—*i.e.* for about 33 kilomètres—is from 1 to 3 mètres (the latter after heavy rain), and its width averaging 400 mètres; its banks, too, seem to be frequently under water. Probably, however, in combination with a parallel stream, the Adler, it drains an extensive level district higher up. The fruits washed down—nutmeg, citrons, coconuts, etc.—seem to show this, and the wrought timber which comes down shows that there are inhabitants. The valley of another river, the Franziska (we hope the native names may be forthcoming later) further south, showed much more available land, not only in its immediate valley and in its islands, which are already occupied and well cultivated by a superior class of natives—the chief crops being taro, bananas, and sugar-cane—but also on the mountain slopes further up, the stream apparently dividing the Herzog from the Kuper ranges. At the base of the former, near the mouth of the Markham River, is a series of those fresh-water lagoons, parallel with the coast, and peopled with amphibious dwellers in pile-houses, which occur on the other side of Humboldt Bay and elsewhere. Between them and the sea is a sort of bar, through which the surplus fresh-water finds its way out.

Another expedition, reported on by Dr. Schrader, has ascended the Augusta River in the *Samoa*. The river was about 50 mètres higher than on the voyage of the *Ottilie*, and the *Samoa* is calculated to have ascended about 380 English miles in eight days, and to have reached a point 80 miles further. The furthest point, however, is estimated at 141° 50′ E. long. and 4° 13′ S. lat.; and the furthest record of the *Ottilie* gives the same meridian, and only 3′ further south. At the *Samoa's* furthest there was still 10 feet of water; and no doubt when the river is higher, as at times it is, it would be navigable even for sea-going vessels to a greater distance. Several navigable streams join the Augusta on the right bank, apparently leading far up into the comparatively

elevated country on that side. This great river, then, is no mere fluctuating torrent. The fall, through the estimated 380 miles, is calculated at no more than 20 mètres; and, from the appearance of the country, it was thought that the lagoons, frequent all along the left bank, continued higher up. A range of mountains, estimated at 1000 mètres in height, lay some 20 miles to the west and west-by-north of the furthest point reached. It seems pretty clear that the Augusta and its tributaries will afford access to a great extent of new country.

From **Mioko** (Duke of York group), it is reported that the inhabitants have through their chiefs formally submitted to the New Guinea Company, agreeing to give up various barbarous customs, and in future to refer all their disputes to the arbitration of the manager.

Various experiments in cultivation continue to be made at Constantinhafen, with satisfactory results as regards maize and tobacco, and various vegetables, as tomatoes, water-melons, etc.

The Nachrichten über Kaiser Wilhelmsland u. der Bismarck-archipel., 1888, Heft. I., gives the results of some explorations in **New Pommern** (New Britain). On the north coast, the large islands Willaumez, Raoul, and Du Faure, though their position on previous charts is approximately correct, are reported not to be islands at all, but parts of the mainland. The conformation of the country is said to afford much more available land than that of New Guinea opposite, the distribution of the mountains giving a much larger proportion of valley or level country; a wide extent of well-watered plains was seen, and on the south coast, west of Cape Merkus, a river was discovered, said to be second only in importance to the Augusta River.

A visit to the **Purdy Group**, between the Admiralty Islands and New Guinea, is also recorded. The islands are four in number, coral, only 1 to 2 metres above the sea; the flora occurs in concentric rings, the coco-palms next the sea, then a belt of wild taro (*colocasia esculenta*), then areca palms; the centre being occupied with the ordinary mixed flora of these islands. A party of Admiralty Islanders were met with, who had come to extract oil from the abundant coco-nuts, and carry it away in large india-rubber flasks!

Population of New Caledonia.—According to the official *Gazette*, the population of New Caledonia, on 30th November 1887, numbered 62,752 souls. This number was made up as follows:—Free colonists, 9061; liberated convicts (*libérés*), 2515; convicts (*détenus*), 7477; natives, 43,699. The free population amounted to 8186 Frenchmen (4710 emigrants, 1714 soldiers, and 1762 officials with their families); 429 Englishmen; 60 Germans; 50 Italians; 47 Belgians; 44 Swiss; 50 other Europeans; 15 Americans; and 180 Asiatics (of whom 109 were Chinese) and Africans.—*Deutsche Rundschau*, April 1888.

GENERAL.

Currents of the Atlantic.—The first cruise of Prince Albert of Monaco in his yacht *Hirondelle* for scientific purposes in 1885 was noticed in the Magazine, vol. ii. p. 507. Of the 169 floats thrown into the sea north-west of the Azores in 1885, eleven had come ashore on those islands, and three others at Madeira, the south of Portugal, and the Canaries, up to June 1887. These had travelled with an average speed of about three miles per day. In the summer of 1886, another cruise was made (see *Compte Rendu*, 20th December 1886, and *Bull. de la Société de Géographie de Paris*, 4me trimestre, 1887) during which the Prince and Professor Pouchet, in addition to a considerable amount of dredging,

launched 510 floats to test the direction of surface drift in the North Atlantic. The floats on this occasion were ordinary bottles, containing a paper sealed up in a glass tube; they were thrown over at distances of half a mile in three series, separated by intervals of 20 miles, along the meridian of 17° W., from a point nearly off Cape Finisterre in lat. 43° N., to 50° N. off Land's End. This operation occupied six and a half days, from August 29th to September 5th. Of these, 36 floats had come ashore up to the time of writing, most of them in the Bay of Biscay, showing an average speed of nearly $5\frac{1}{2}$ miles per day, and a general drift in the direction south 80° east, or nearly east-by-south. During June, July and August 1887, the *Hirondelle* was engaged in a third cruise on a more ambitious scale (*Compte Rendu*, 24th October 1887). 931 glass floats sheathed in copper were thrown over, at intervals of a little more than two-thirds of a mile, between the Azores and the Banks of Newfoundland, crossing the course of the Gulf Stream, where its breadth is computed at 600 miles.

The current observations will probably prove of less importance than the zoological work carried on at the same time. Large collections were made with the assistance of Professor Pouchet and M. Jules de Guerne, and it was found possible to dredge without steam-power at depths down to 1300 mètres, or 710 fathoms, the steel-wire line being worked by twelve men. Temperature observations were also made at intervals; but the full particulars of the cruise have not yet been published.

On Distribution and Density of Population.—M. Victor Turquan, Chief of the French Statistical Bureau of the Ministry of Commerce and Industry, submitted at a recent meeting of the Paris Geographical Society (see *Compte Rendu*, No. 3, 1888), an account of the efforts that had been made to determine, with exactitude, the geographical distribution of the population in France. The importance to geography of knowing the density of population is very great: it brings out the relation between man and the soil. Men are attracted to the soil by the mineral or agricultural riches it possesses in certain regions, and they avoid malarious or unproductive districts. M. Turquan compared the present density of the population in France (72 inhabitants to the square kilomètre), with that of different parts of the world, and the principal countries of Europe. Regarding the earth as a whole, he found it to show 10 inhabitants to the sq. kilomètre; Europe, 34; Asia, 19; Africa, 6; Oceania, from 3 to 4; and America, from 2 to 3. In Europe, Belgium possesses 204 inhabitants to the square kilomètre; the Netherlands, 133; the United Kingdom, 119; Italy, 105; Germany, 86; Switzerland, 70; Austria-Hungary, 59; Portugal, 50; Spain, 34; Greece, 31; Turkey, 27; Russia, 17. Finally, the Scandinavian countries, where the population is less dense, had respectively,—Denmark, 15 inhabitants; Sweden, 11; Norway, 6, to the square kilomètre. M. Turquan entered into greater detail in dealing with the population of France. He referred to the striking solitude reigning in the greater part of the Champagne, and the hills of the Côte-d'Or, in the Alps, the delta of the Rhone, the Pyrenees, the Landes, and the Berri. It is remarkable that the concentration of the three million inhabitants of Paris is found in a restricted space, in the midst of vast regions relatively but sparsely inhabited. Great Britain, densely populated as a whole, shows the majority of her people collected on the coasts. In the basin of the Loire, M. Turquan showed that the population faithfully accompanied the waterways. An uninterrupted line of very dense population is found at the foot of the Pyrenees, from Bayonne to Foix, and along the course of the Garonne. The same group of population also throws out a very important ramification as far as the Rhone. The mountains

are, ordinarily, denuded of population ; the people take refuge in the valleys. On the other hand, he points to rich mining centres (*e.g.*, the Gier Valley, Saint-Étienne, Tarare, etc.), where the population showed an exceptional density. In concluding, M. Turquan showed that the grouping of the population depended on the nature of the soil that nourished it, and that in consequence, this grouping, in the large majority of cases, might be considered as comparatively stable and permanent.

Dwarfish Races.—*M.* A. de Quatrefages has recently (says *Science*) published a historical review of the ancient and modern reports on dwarfish tribes. Although formerly the descriptions of ancient geographers were considered untrustworthy, many of them have been confirmed by recent explorations. Among these are the tales of the Pygmies. Aristotle and Pliny state that a dwarfish people lived near the swamps of the upper part of the Nile. De Quatrefages considers this tribe identical with Schweinfurth's Akka, who at the present time live a little further south. Pomponius Mela mentions dwarfs who inhabited the neighbourhood of the Red Sea. This report was confirmed by Léon des Avanchers' discovery of the dwarfish Wa Berikomo, who are said to be only $4\frac{1}{2}$ feet high, and by D'Abbadie's visit to the Maze-Mollea, who live further to the north. Herodotus tells of a dwarfish black people on the banks of the Niger. His description of the land still holds good ; but, instead of Negroes, Berbers and Tuareg inhabit those regions. At the present time the most northern place in West Africa which is inhabited by dwarfs, is Tenda-Maje, where they were met with by Mollien in 1818. Pliny mentions, besides the dwarfs at the sources of the Nile, others living in what is now south-eastern Beluchistan, where the Brahui, a people of Dravidian lineage, are found. Ktesias speaks of Pygmies who inhabited Central India. Mr. Rousselet found in that region the dwarfish Bandra-Lok, who live in the Vindyâ Mountains. De Quatrefages considers all Asiatic dwarfish tribes as one group, which he calls Negrito, while the African ones are called Negrillo. His researches lead him to the conclusion that the traces of this race are found extending from India through Ceylon and Further India to the eastern extremity of New Guinea, and northwards through the Philippines, to Japan. In most regions they are mixed with other races. He considers the Dravidian one of the most characteristic results of this mixture. It is only on the Andaman Islands and a few other isolated points that the pure race is still in existence. The author shows that individuals of Negrito type occur among the Pariahs of India, and that isolated communities in many parts of south-eastern Asia have retained the anthropological characters of this dwarfish race. De Quatrefages considers the Negritoes of all these widely separated regions to be one race, which originated in Southern Asia. When the yellow race migrated southward and the white race eastward, they were compelled to take refuge on the islands, and to migrate to more southerly countries. Thus they populated the Eastern Archipelago, and crossed to Africa.

ROUTES, RAILWAYS, CANALS, ETC.

The *Panama Star and Herald* of the 25th February says :—"On the 22d inst., the long-looked-for opening of the **Panama Canal** through the Mindi Hill, four miles from Colon, was finally accomplished. There is now a continuous waterway open from the sea at Colon to a point near Bojio station, on the Panama Railroad ; or, in other words, for about 15 English miles, with a depth sufficient to float a 1000-ton vessel."

Project of a Commercial and Military Port at Cabourg.—The French Government have under consideration the creation of a commercial and military port at Cabourg, in the Department of Calvados, which would command the mouth of the Seine. Cherbourg and Havre are open to attack and other objections. It has therefore been proposed, by M. A. Piat, to construct a deep-water canal without locks, from the shore of the English Channel to a short distance within the low-lying valley, where the military and commercial port would be built. This unique inland port, with the canal conducting to it, would thus present the diagramatic appearance of a bottle.

The Trans-Siberian Railway.—The Russian Government have decided to commence in the spring the survey of the Trans-Siberian railway between the market town of Pasolski, on Lake Baikal, and the town of Sretensk (Stretyinsk), situated on the (navigable) river Shilka. The length of this line, between the two points, will be about 950 miles. From Pasolski, the railway will thus pass Verchné-Udinsk, Chita, and Nertchinsk. In the event of the construction of the line and of another railway from Tomsk to Irkutsk (surveys of which are already being undertaken), and with the river-system of the Obi, the Upper Tunguska, the Shilka, the Amûr, and Lake Baikal, Russian Europe will be united to the Pacific. It is expected to commence work in 1890.—*Baron Bieberstein in Compte Rendu* (No. 5, 1888) *Paris Geographical Society.*

MISCELLANEOUS.

The **Meridian of Greenwich** has been officially recognised by Japan.

Blackwood's Magazine for April contains a paper by Mr. Coutts Trotter on **Fiji.**

A destructive earthquake is reported to have taken place last December in **South-west China.** Particulars are wanting.

It is reported that Dr. Heinrich Kiepert, accompanied by Dr. Fabricius, is about to undertake a new journey in **Asia Minor.**

Mr. Gordon, writing from Uganda on 16th November last, says, that up to that date no news of the arrival of **Mr. Stanley** had come to hand.

The Government of Finland have decided to institute, at different stations on the coast, systematic observations on the movement of the **Drift-ice.**

M. Jaccotet publishes a good review of **Geographical Progress during 1887** in the *Bulletin de la Société Neuchateloise de Géographie*, tome iii., 1887.

Through a clerical error, the discharge of the **Thurso** was wrongly given in last month's Magazine. The correct figures are 25,179 cubic feet per minute.

A Pitch Lake in British Guiana is reported to have been discovered at the mouth of the Waini River, or on a tributary of the Barima, above the Mora passage.

Danish papers report that the **Öresund** was during the winter frozen from shore to shore, from a few miles north of Copenhagen to Landscrona, on the Swedish coast.

The *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, No. 132 (1887), contains a very valuable and extensive classified **Bibliography of Geographical Publications**, by Dr. E. Fromin, for the year ending November 1887.

The Journal of the China Branch of the Royal Asiatic Society (vol. xxii., Nos. 1 and 2, 1887), contains a list of the names of the sovereigns of the **Old Corean States**; and a chronological table of the present dynasty, by Ludovico Nocentini.

According to the census of October 29th and 30th, 1887, the chief towns of the **Argentine Republic** had a population as follows:—Buenos Ayres, 424,873; Córdova, 56,459; Rosario, 50,914—showing an increase, since the census of 1869, of 139, 98, and 127, per cent. respectively.

Globus (No. 14, 1888) reports that the French Lieutenant Dolizie has been forced to relinquish his purpose of ascending the **Mobangi River**, into the unknown territory of the French Congo, in consequence of the hostility of the natives, who killed several of his followers.

M. Potanin, the traveller, gives an account of his three years' journey through the Eastern Gobi, Southern Mongolia, and Eastern Tibet, in Nos. 3 and 4, 1887, of the Russian Geographical Society's *Isvestiya*. The two maps illustrating his paper abound in new data, and are very valuable.

Dr. Joseph Troll, the Eastern traveller, is about to undertake a new journey through **Asia**. Starting from Russian Turkestan, he proposes to go to Bokhara and Chinese Turkestan, and from thence either through Kashmir to India, or across China. He has been dissuaded from going to Tibet.

The travellers Sandalio Sosa and Dr. de Bourgade (*Globus*, No. 14, 1888) have returned from their explorations in north-east **Paraguay**. They have investigated the geological and geographical conditions of the Jejui and Igatimi, two tributaries of the Parana. Among the natives, who received them in a friendly spirit, they report the discovery of a hitherto unknown tribe, called by their neighbours the Apytere (inhabitants of the centre).

The *Colonies and India*, of 4th April 1888, announces that quite recently a party of thirteen Afghans, with over one hundred camels, left Perth for Port Augusta, in **South Australia**, overland. They were to take the route to Beverley by road, and then by way of the telegraph route to South Australia. A white shepherd went with them for part of the distance to guide them through the pestilential country, which is about 200 miles in extent. From there they will have to make their way as best they can, guided by the maps they have with them.

In a letter from **New Guinea**, dated February 11th, our Corresponding Member, Mr. H. H. Romilly, states that details regarding Mr. Bevan's recent expedition to the rivers entering Port Romilly have not yet been received. Mr. Bevan is preparing for a new expedition up the St. Joseph River, a stream which enters the sea at Hall Sound, with the purpose of prospecting the locality for gold. Travelling in New Guinea is extremely arduous during the rainy season, the rivers being as a rule unsafe for navigation until the close of the rains in the end of April.

The *South American Journal* (14th April 1888) publishes two communications in regard to the **Falkland Islands**. The first is from Sir F. Packenham, British Minister at Buenos Ayres, to the Argentine Minister of Foreign Affairs, who, in reply, says:—"The Argentine Government maintains its protest with respect to the illegitimate occupation of the Malvinas Islands [Falkland Islands]; it does not abandon, and never will abandon, its rights to these territories; and at all times, until justice is done, it will regard them as forming an integral part of the Argentine dominion, founded on priority of discovery, on priority of occupation, on possession initiated and exercised, on tacit and explicit recognition, and on acquisition by treaty of those titles which belonged to Spain."

NEW BOOKS.

The Balance of Military Power in Europe. By Colonel Maurice, R.A. Professor of Military Art and History at the Royal Staff College. Blackwood, 1888.

Colonel Maurice's articles in *Blackwood* deserved reprinting. They attracted the attention of foreign statesmen, and ought to receive that of our own. The leading qualities of his book are keen observation and trenchant argument. Its style is too controversial, but it fortunately contains a good deal of permanent as well as ephemeral matter of much interest to geographers as well as politicians. Its purpose is not to add to the already too large political forces which make for war, but to strengthen those which make for peace. Its view of the present condition of European and Asiatic politics may be summed up in two or three sentences. It is the duty of this country, according to Colonel Maurice, to ally herself with the German powers—Austria as well as Germany proper, and with united Italy, in order to prevent, or if necessary to cope with, aggression on the part of Russia. This duty may be best discharged by maintaining the navy in the highest efficiency, by adequately protecting the coaling ports as vital not only for the action of the navy, but for the safety of the British mercantile marine, and, without materially increasing the army, by making sure that all its branches are effective, and all its members from the private to the highest rank intelligently trained. While the small number of her army prevents Great Britain from competing with the great military powers, her navy enables her to offer to Germany, Italy, Belgium the support these States most require if attacked; and entitles her to require from them in return the aid of their land forces if necessary, to create a diversion or supplement her own should she be threatened at any point of her wide and scattered empire. While it has been necessary to state without expressing an opinion on its merits—which is beyond our competence—the drift of the argument, those parts of this work which deal with geographical matter fall directly within the province of a Geographical Magazine. The testimony borne by men of science and by writers of history, by the trader and the traveller, to the uses of geography, is here confirmed by a soldier, who writes with the consciousness which may seem pride, but is at least a noble pride, that no mere theory, but the lives of men, may depend on his words.

Geography presents itself to the military critic from an opposite point of view from that of the discoverer. He deals not with the unknown or the less known, but in general with what are supposed to be the better and even the best known parts of the earth's surface. But as regards these he is as urgent as a professional geographer on the necessity of full and accurate knowledge. His main geographical problems or inquiries are two. The first is, What are the conditions nature or art has given to particular countries, districts, lines of frontier, and places relative to defence from, or attack by, an enemy? The second is, What are the facilities or the difficulties presented by particular routes by sea or land for the transit of armies or their supplies? The former inquiry is the necessary basis of the art of fortification, the latter of the art of strategy or tactics. Good maps are essential in both inquiries, and are as necessary to the soldier as charts to the mariner. It is no accident that we owe the best maps, as the Germans also do, to a branch of the military service.

With regard to the British Isles, Colonel Maurice says little, probably

reserving this part of his subject for a work on *National Defence* he is to contribute to "The Citizen Series." Still, we may infer from this silence that he is not an alarmist with regard to the risk of an invasion. Almost the only allusion he makes to it is to cite Wellington's despatch that "the true principle for an English patriot is not to make preparations for fighting an army at home—though in a manner that too is needful—but to strike blows abroad which shall keep the shores of England sacred from invasion." It is the Indian frontier, the Colonies, the coaling stations, the large portion of the wealth, and the number of the citizens of Britain constantly afloat that appear to him weak points of the Empire. It is his object to show how they may be strengthened. One of his leading ideas, borrowed from a phrase of Kinglake, is that Britain is an amphibious power whose influence is greatest where land and sea intertwine. The ocean as well as the land requires therefore to be kept constantly in view, and the importance, from a military standpoint, of the line of research which Mr. Murray has initiated is manifest. With regard to Russia, not only Colonel Maurice, but almost all military authorities and the statesmen who have studied the subject most, are, we fear, alarmists. They point out the continuous growth of her gigantic empire. They note the persistence of a foreign policy which seems always to have one eye on Constantinople, and another on India. They contrast the fixed purpose of the traditionary policy of her autocratic government with the vacillation of popular states. They admit that internal difficulties weaken her, but remark that these difficulties may induce her as a desperate remedy against revolution to try the hazard of war. They quote with irony the saying of Cobden, the best representative of the peace party, that Russia could be crumpled up like a sheet of paper, and remark that it is a pity he did not do it; or that of the Duke of Argyll about Mervousness, and note that Russia is steadily extending lines of railway of little use for trade, but by which her troops could be poured down on India, and that she now threatens from close quarters Herat and the Heri Rud. This line of argument is beyond doubt of practical value, and it is folly to disregard it. But it is equally unwise to neglect other signs which the better knowledge of Russia and the Russians have brought home to us. If Russia has had statesmen like Ignatieff, it has also had patriots like Gogoll, Kriloff, the two Turgenieff, and Tolstoi. It is neither just nor politic to regard any portion of the human race as permanently hostile to another portion of it. There is not only an under-ground Russia whose password is Nihilism ; there is also a larger and hitherto dumb Russia learning to speak through such writers, and its language is not that of aggression and international rivalry, but of peace and internal reform. Nor is this better feeling without its influence in the highest places. One of the last words of the German Emperor William was that the Tzar had declared he would not make war on Germany. That such a declaration should be necessary warns us how near the danger was, and perhaps still is. As a defence against it Colonel Maurice points out the great strength of the frontier of Germany if united with Austria against any Russian advance in Europe. This is a question which depends largely on geographical considerations. The map prefixed to his book proves, we think, this point of his argument. It shows that while the wedge of Russian Poland brings her within 200 miles of Berlin, that wedge is so tightly enclosed by East and West Prussia, Silesia, and Galicia, with the Carpathians as a natural rampart of Hungary, that no land-force Russia could bring to the front could be expected to out-manœuvre the allied forces of Germany and Austria. Again, the same map raises another geographical point. The great seaboard towns and ports of East Prussia, Memel and Königsberg, and of West Prussia, Danzig and Stettin, are evidently very much at the

mercy of whatever power commands the Baltic with its navy. It is by her navy Colonel Maurice urges that Great Britain could lend such effective support to Germany, if threatened or attacked by Russia, as to free a considerable portion of the German land-forces. If Russia were to threaten or attack any part of the British empire, Germany could, if aided by the British navy, as he puts it (omitting some unnecessary words), "for the defence of her country, subtract 200,000 men from her armies. Therefore here is a figure of at least 200,000 men we can add to the militant forces available for the central alliance. Moreover, here, as elsewhere, we can act quicker than any other power. From the moment our alliance is known to be secured, all danger of a Russo-Franco-Danish action vanishes; German generals can work out their campaign with the full addition of the 200,000 men, whom otherwise they must subtract from offensive war."

A similar argument is repeated as regards Italy. Italy has geographically, in the North overwhelmingly strong defence in the Alps even now they are crossed and pierced by railways and tunnels. But its sea-board within easy reach of its great towns is unprotected by any ports of consequence under the new conditions of naval warfare. Colonel Maurice quotes a significant speech of General Ricci, late chief of the Italian staff: "Each time that I as General of Army and Alpine deputy appear in Parliament I shall say all for the navy." But though Italy has spent large sums on her fleet it is still inadequate for the defence of her coasts, and the English Mediterranean Squadron could at once relieve that brave nation so ready to accept an English alliance from any apprehension on this score. Her army could then lend a valuable contingent to the Central European alliance. Apart from his main argument, we note the following points of geographical interest in this work. It notices in several places the value for military purpose of the lines of communication established by the railways of the Continent. Railways and not roads are now the routes of war as of trade, and this suggests the remark that a map of Europe laying down the main lines with an exact statement of distances and an approximate estimate of time for transit, both of passengers and goods, would be a useful work. Such a map may exist, but is not within our knowledge.

Another point which Colonel Maurice naturally treats is the exact statement of the geographical frontiers of the European States; for from these the military problems he discusses necessarily start. We direct attention to his statement of the French frontier, p. 96 and 97; that of Germany, 98 to 100; that of Austria, p. 160; that of Russia, p. 133; that of British India, p. 53; and to his remarks on the importance of Silesia, p. 146; and of the Carpathians, "with Galicia as a glacis," p. 161. As regards England he makes the comment that her frontier is the sea. By this he means not the "silver streak," or the four seas of the British Isles, but the ocean generally, and he contrasts this with the ring-fence of the German Empire (p. 84). One other point may in conclusion be mentioned. We are forcibly reminded by this work how an obscure place to the majority of Englishmen may suddenly acquire great importance, and render it necessary that geographical knowledge should be brought to bear upon it. We refer to his remarks on such places as Vladivostok at p. 69; Port Hamilton, pp. 176 and 246; and the Comoro islands, p. 177.

It is surely wiser that the necessary knowledge should be gained by geographical study beforehand, and should not be hastily and imperfectly acquired at moments of emergency when many other matters of urgency have to be attended to.

Travels in Arabia Deserta. By CHARLES M. DOUGHTY. Two vols. Cambridge: At the University Press, 1888.

Seldom does a work appear of such very varied interest as this one. It will be read for its English style, which is archaic and studded with obsolete words, but always natural, sustained to the end and charmingly suitable to the subject; for its pictures of desert scenery and life; its powerful analyses of the Semitic genius; its very keen, often humorous, portraits of individual character; and its adventures and hairbreadth escapes, of which there is a wealth beyond even the dreams of Rider Haggard. Mr. Doughty performed the unexampled feat of travelling openly as a Christian and an Englishman, throughout the greater part of Northern and Central Arabia. He started with the Mecca caravan from Damascus in the autumn of 1876, accompanied it as far as the Haj station, El-Hejr (six marches before Medina), where he stayed some time, to take surveys and drawings of the Nabatien inscriptions on the rock-tombs, known to the Arabs as Medain-es-Salih. It is interesting to compare his experience of the Haj with Ludovico Varthema's by the same road in 1504 (London: Hakluyt Society, 1863). Nearly four centuries have not changed the habits of the caravan, nor the attitude to it of the nomadic tribes through whom it passes. From El-Hejr Mr. Doughty wandered through the deserts for over eighteen months, keeping chiefly to the east of the Haj road, and breaking the monotony of life among the nomads by residence, for weeks at a time, in the oasis of Teyma: at the Wahabee town of Hayil, in Shummar; in the volcanic plateau of Kheybar, above Medina, Turkey's furthest inland garrison; and at Boreyda and Aneyza, in the province of El-Kasim. Thence he travelled with the butter-caravan, in the height of the summer of 1878, to within one march of Mecca, where he most narrowly escaped murder. At e'Tayif he came under the protection of the Sherîf of Mecca himself, and was by him passed on to Jiddah, where his narrative ceases. He thus zigzagged over some 20,000 square miles, and has come forth with a vast amount of information about Beduin manners, Wahabee customs and politics, the attitude of both Wahabees and Bedu to "the Dowla," or Turkish government, and the vocabulary of inland Arabia. A number of scholars have assisted him with the revisal of the Arabic he has gathered; M. Renan has translated his inscriptions; and on other points his volumes contain contributions from well-known authorities.

The geographical value of these *Travels* is considerable, and has already been made use of by cartographers; for Mr. Doughty's *Itinerarium* was previously published in Kiepert's *Globus*, and then by the Royal Geographical Society. His map is now coloured geologically, and an appendix, with sketches, is added in explanation. "The geology of the peninsula is of truly Arabian simplicity: a stack of plutonic rock, whereupon lie sandstones, and upon the sand-rocks, limestones. There are, besides, great land-breadths (such as the Hauran in Syria), of lavas and spent volcanoes." Of these *Harras*, as the Arabs call them, Mr. Doughty has much to tell. A long band of three, the el-Aueyrid, lie north and south some hundred miles, to the west of the Haj road. Mr. Doughty spent some time with the Moâhib at their spring pasture, in the southmost of the three, and found its mean level to be above 5000 feet, with a summit of over 7600. A series continues along the Derb-el-Haj to Mecca, seven degrees of latitude. Smaller ones are seen from the Red Sea, on the coast. Kheybar, "the apostle's country," above Medina, is another, running north-east for over a hundred miles, with a breadth of about forty. These lava-caps have curiously protected the sandstone immediately under them, so that it stands higher than

the surrounding country of the same formation, which has been denuded below its level. The Aueyrid are "wild tempests" of stone, split by deeper gorges, on which are found few scraggy trees and hard bushes, with an occasional blush of grass, and here and there a nasty pool of water. Snow sometimes falls on their heights, and even in the middle of summer the air is bracing. In the heart of Kheybar there is a great oasis (2800 ft.), with fields of corn, palm-groves, wells, brooks even, a damp ground, with scabs of rusty salt, and a marshy atmosphere. The fashion in which the husbandmen of this oasis hold land in partnership with the Beduin, who come in once a year for their half of the date-harvest, is unique. The Beduin's inalienable share would seem to have been originally blackmail. In 1874 the oasis passed from the supremacy of the Wahabees to the direct oversight of the Porte, who have placed a garrison there, and, it is interesting to know, in contrast with the ways of Turkish government everywhere else, have put the town into greatly better order and health. "The Kheybar valleys are reckoned neither to the Hejâz nor Nejd." Of life in Aneyza, where he spent two months, Mr. Doughty draws a very attractive picture. Welfaring tradesmen and farmers—several thousands of a population, doubling in the last fifteen years; cheerful livers in a serene air, and under a generous ruler; in communication with the Persian Gulf; many of them gentle and liberal, travellers and readers,—the foreigner felt himself more at home among them than anywhere else. Land is valued there at over £100 an acre—even the cheaper sort, and lying far from town. One merchant's annual domestic expenditure is reputed at £400; the fortune of the greatest merchant in the place at £24,000. Here are many horse-brokers for the India market, but horses are neither bred nor sold at any town in Nejd. Young stallions are bought from the Arab tribes, brought in from the desert to Aneyza, Boreyda, and Háyil, to be accustomed to green food and fattened, before the long desert journey, which is seventeen marches from El-Kasim to Kuweyt, where they are shipped for Bombay. The nomad Arabs believe the horses to be sprung from the soil of Arabia: they allowed Mr. Doughty might have knowledge of all other things, but not of horses—"for they are of the Aarab." The Beduin horses get no corn in the desert; the few hard stalks of grass are unable to sustain them, and they are very intolerant of thirst. They are fed, therefore, with milk; a foster camel is told off to each horse, and the nomad will milk for his horse before his family. The figures which Mr. Doughty furnishes of the population of various districts are, unfortunately, too few to make possible a general estimate of the population of the whole peninsula. He has sketched the outlines of the greater mountain-ranges, and of most of the hills used as landmarks by the nomads. He was able to take temperatures and altitudes. He has roughly mapped out the districts, pastured by the various tribes, and given the drainage slopes, either from his own observations, or from the report of Arabs, who, in this detail of geography, and in this alone, can be trusted to give tolerably accurate information. He marks the probable limit of the monsoon rains, which he very properly suggests as the just division between Arabia Felix and Arabia Deserta. There are a multitude of other interesting facts of topography, geology, the influence of the climate on the genius of the people, etc., to all which there is a quite sufficient index.

The extent to which Mr. Doughty's previous publications have been made use of by geographers, is sufficient proof that these volumes. full of additional information, will remain a standard work on the great peninsula.

The Government Year Book. A Record of the Forms and Methods of Government in Great Britain, her Colonies, and Foreign Countries. Edited by Lewis Sergeant. London: T. Fisher Unwin, 1888.

The British literary public can hardly complain that their wants are not fully supplied with books of reference, as recent years have given birth to quite a number of excellent works of this class. The volume now before us has for its editor the well-known author of *New Greece*, Mr. Lewis Sergeant, and bears the somewhat official-sounding title of *The Government Year Book*. It may be regarded as aiming to occupy a position alongside the *Annual Register* and the *Statesman's Year Book*, and it fills up in some respects the department of the last-named work which is perhaps least satisfactory, that of *Constitution and Government*. In the Preface, Mr. Sergeant describes the *raison d'être* and plan of his book. "The aim," he says, "of the *Government Year Book*, to put it into the fewest and simplest words, is to exhibit the principal forms and methods of government in each particular State, and then, having these facts laid down for ready reference and comparison, to review each year the most striking of contemporary events, and to note how they hinge upon or tend to modify political organisations. Where written constitutions exist they have been either quoted in their entirety or analysed; and the different constitutions have been incidentally compared with one another. In the absence of a formal constitution, greater stress has been laid upon the historical development of national institutions. The sole object throughout has been to furnish a compact and symmetrical account of the methods of government in various quarters of the world." The plan is a good one, but whether there is sufficient demand for a book of the kind, to make it successful as a commercial speculation, is, to say the least, very doubtful.

We have to express general satisfaction with the clearness of arrangement of the subject-matter. In an introductory chapter we are given an account of the development, progress, and present state of international relations, and to this is subjoined a useful list of the principal treaties, conventions, and conferences entered into since the time of the first Napoleon. Mr. Sergeant is, as a rule, judicious in the comments he makes from time to time on this subject of internationalism, though one may not always agree with his conclusions. We are somewhat surprised, however, that in the description of the progress and reform of international law, no notice has been taken of the international postal and coinage systems. The general Postal Union and the adoption by the so-called Latin States of a common system of coinage and weights and measures have been of the greatest possible importance in the field of international intercourse. We also fail to find any reference to the efforts which are being made by the well-known International Law Associations to establish uniform codes of Commercial Law among the European States. The most valuable results may be anticipated from the labours of the recent conferences at Brussels, Antwerp, and London.

As we are dealing with a first edition, we shall not lay stress upon the errors and omissions we have noticed. On page 107, among the list of British colonies and dependencies, Cyprus has been omitted. The information given about Scotland is next to worthless. Though the editor professes to deal with Great Britain, we are told absolutely nothing about Local Government in Scotland. It is an error to say (page 56) that the Secretary for Scotland must sit in the House of Commons. Among the list of principal convict prisons (page 62) Perth Penitentiary is not mentioned.

We think it might be an improvement if the names of the representatives (if any) accredited to our country, as also if our representatives abroad, were added to the description of the several Governments. Such information would prove of much service to those consulting the work, and would take up but little space.

An Elementary Geography of the British Isles. By Archibald Geikie, LL.D., F.R.S., etc., etc. London: Macmillan and Co., 1888.

This, the first number of *Macmillan's Geographical Series*, has been prepared in accordance with the method of instruction explained and advocated in the author's book on "The Teaching of Geography," which is the foundation of the whole series. The principle that lies at the root of Dr. Geikie's teaching is that geography should be a real, and not merely a verbal study—that it should be treated so as to appeal to the observing powers, the judgment, and the imagination of the scholar, and not merely to his memory. This root principle has been carefully observed in the present little book. It does not consist, like the old text-books, and some of the new ones, of mere lists of names, that are "linked with no idea or association." Each place, in accordance with the author's rule, is "connected with some physical feature, some fact in history, or some other human interest." That is excellent, and it is admirably worked out in the book. So also is the description of the physical features of the British Isles, on which the political geography is founded. The book approaches in its scope more nearly to the geographical reading-book, than to the text-book of geography. It contains fewer facts and names than the latter, but more than the former; and the facts are both stated in a charming style, and grouped in an interesting way. Dr. Geikie's method certainly makes the teaching of geography more intelligent, but it still requires the scholar to "get up" a large amount of book-work. To master forty-one pages of description of the shires of England and Scotland, and of their towns, will not exactly be child's play; and it must not be forgotten that the scholar has here to deal, not with direct nature-knowledge, but with book-knowledge, just as was the case under the old system. The book is called an "elementary" geography, but it is adapted in its style, and scope, and price, to the requirements of secondary schools. One of Dr. Geikie's statements is rather startling. It is that the number of passengers carried over British railways in 1886 was 72,500,000,000. We are told, further, that the total receipts "from passengers and goods," amounted to £69,000,000. Supposing one-half of the receipts to have been on account of passengers, the rate would be a little over half-a-farthing a-head, which is a rate unknown to British railway companies. He also tells us that the town of Ayr "contains the tomb of the poet Burns." Every one who has visited the pretentious mausoleum at Dumfries will wish that *that* were true. By the statement on page 18 it would appear that the British Islands have 102 per cent. of land surface. While no objection can be taken to the definition "Inverary—a quiet, sleepy place out of the way," the conclusion "at the head of Loch Fyne" is wrong by six or seven miles. These, however, are blemishes inseparable from a first edition.

Through the Yang-tse Gorges; or, Trade and Travel in Western China. By Archibald John Little, F.R.G.S. London: Sampson Low, Marston, Searle, and Rivington. *Price* 10*s.* 6*d.*

It is strange that though Western civilisation has been loitering so long at its gates, and clamouring to get in—though it has held an official "permit" to

enter with its goods for the last dozen years—so little is known and so much remains to be seen of that part of China lying beyond the gorges of the Yang-tse. Since the days of Captain Blackiston and Dr. Barton's survey twenty years ago, few Europeans have passed inside the portals of Szechuen, and little or nothing is changed. Mr. Little is one of the few, and his interesting volume enables us better to understand, among other things, why the magnificent country and industrious and intelligent population of Western China have remained so long cut off from the rest of the world. The obstacles have been in part political and artificial: jealousy of foreign intrusion and the multiplicity of *likin*, or local tax, barriers—of which a legion are planted along the "gorges" of the Yang-tse—have operated to exclude European trade and European ideas, and Mandarin ingenuity has discovered means of evading or destroying the advantages of the system of "transit passes" and the other provisions for the encouragement of commerce with the upper portion of the Great River contained in the Chefoo Convention. There are other obstacles, however, which are geographical—the result of the formation of the country, and the natural impediments presented to intercourse with it. The roads leading into Szechuen are little better than footpaths; and traffic has perforce to run the gauntlet of the rapids and cataracts extending for 140 miles above the river-trading port of Ichang, where the Yang-tse cuts its way, in a series of magnificent chasms, through the last of its mountain barriers, to the level of the plains of Hupeh. The passage of these rapids is not only attended by great risk and loss, but can only be made under certain conditions and at certain seasons; and thus Szechuen, with its fine climate, its rich soil, its teeming population, and its inexhaustible stores of mineral wealth, remains for the most part a "sealed book" to the rest of China as well as to Europe. Mr. Little is, however, persuaded, from his observations made on his journey to Chung-King, that only the opening of the great coal-field of Szechuen and the placing of steamers of suitable construction upon this difficult section of river navigation are required to develop an immense and profitable trade with the "back country" of China.

His experience of the route and country is of the greater value, as the most perilous part of the voyage was made in small native craft, and in company with the native boatmen and towers—a wonderfully bold and skilful race of *voyageurs*, with whom his knowledge of the language enabled him to hold familiar discourse. In the journey from Hankow to Ichang he left the main stream and followed the interminable series of creeks, lakes, and back-waters that are spread over the face of the country. The floods were out, and over wide tracts, owing to the volume of surplus water being of late larger every season than the insignificant fall of level is able to carry away, a great part of the rice-growing land threatens to be converted into permanent lake and marsh. In other parts of the country—in Shansi and the valley of the Hoang-ho—the desert sand and the desert climate seem to be advancing eastward, and China is menaced by the two opposing calamities of floods and drought. Mr. Little gives a dolorous account of the aspect of the Hupeh plains. He praises the fancy of the Chinese, as displayed in the names and mottoes written on the rocks of the "gorges," at the expense of transatlantic advertising vulgarity; but the Chinese are also capable of vulgar taste, and one of the most romantic parts of the cañon bears the awful title of "Ox-liver-Horse-lungs Gorge"!

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

CAUCASIAN IDIOMS.

By Victor Dingelstedt, Hon. Corr. Member, R.S.G.S.

There is hardly any other country in the world where, on an equal extent of territory, there are living as many different nationalities, and where one may hear as great a variety of strangely-sounding languages, as Caucasia. These languages are of very ancient origin; they have preserved a very prominent guttural character; some of them are agglutinative, and are probably the product of the intellectual life of some of the most primitive inhabitants of our globe. Notwithstanding all the light that the accurate knowledge of such ancient languages would have thrown upon the problems of comparative philology and the past destiny of man, no systematic and exhaustive study has yet been undertaken of all these varied vehicles of human thought and sentiment. The number of those who have laboured in the field of Caucasian philology is small, and the results obtained by their labour—the arduous character of which must not be underrated—is far from being altogether satisfactory. As yet we do not know the derivation of the Caucasian languages, nor their relationship with other known non-Caucasian idioms; neither do we possess grammars and vocabularies of the large majority of the Caucasian idioms. However, there has been no lack of applied capacity in this branch of scientific pursuit. To the number of Caucasian savants who have rendered great service to our complicated study of philology, must be mentioned—before all the Academicians—Sjoegren and Baron General Uslar. Sjoegren, in the fortieth year of the present century,[1] successfully studied the Ossetin language (undertaken latterly by Dr. Pfaff), and General Uslar, an indefatigable worker, some fifteen years later, investigated, with still greater success, as many as seven languages, viz., Abkhasian, Avar, Tchetchen, Lack (Kasikumyk), Dargin, Kurin, and Tabasaran. An excellent account of the life and labours of General Uslar has been given by Mr. Sagursky in the twelfth volume of *Sapisky of*

[1] Sjoegren, *Bul. Scient. de l'Acad. de St. Pétersb.*, Sec. Hist., 1847, iv.

the Caucasian Section of the Imp. Russ. Geog. Society. Besides these two eminent philologists, there were Brossé, George Rosen, Beresin, Schiefner, Zagarelly, Lulié, Sagursky, and some lesser lights, who took more or less trouble to understand the numerous, mostly unwritten, languages spoken by the Caucasian people. In the present sketch I propose to present some idea of the actual position of Caucasian philology.

Caucasian languages are usually, though not precisely, divided into three different groups:—(1) Iberic or Cartvelian, (2) Western Caucasian, and (3) Eastern Caucasian. The Cartvelian group comprises four distinct languages, viz., Georgian, Mingrelian, Lazian, and Svanetian. Some of these languages have distinct dialects, which are spoken by different tribes of Cartvelian origin, such as Imeritian, Gurian, Thushan, Chevsurian, Pshavian. Besides the academician Brossé, who has produced a classical work—*Grammaire géorgienne*—and has translated the works of Wakhoucht, as the most authoritative investigator of this group of the Caucasian languages, we have Mr. Zagarelly, the Professor of Georgian at the University of St. Petersburg. As regards the mutual relation of languages and dialects constituting this group, there are yet some unsettled points. The connection of the Cartvelian tongues with other better-known families of speech is a question that is as yet very imperfectly elucidated. According to Mr. Bopp,[1] there exists a certain affinity between the Georgian and the Aryan family of languages; according to Max Müller, the Georgian group belongs to the Turanian or Turkoman family; and according to Professor Zagarelly,[2] there is no sufficient reason for the admission of either of these connections. The same question has also occupied the attention of Mr. Hide-Clerk, Mr. Lenormant, and others; but nothing definite has yet resulted from their investigations; the differences of opinion remain as great as ever. It has still to be proved by further research whether the Georgian group of languages really has any kind of relationship with other known families of speech, or whether it does not constitute an isolated family, with only a local existence in the Caucasus, its derivatives and affinities in other parts of the world having perished in the whirlpool of human destiny. The analogous opinion has already been some time ago expressed by Klaproth, F. Müller, and Spiegel—that of linguists having found in the Georgian idioms no genetic connection either with Aryan or with Turanian. The number of people of Cartvelian origin is, according to N. de Seidlitz,[3] 850,000 (in 1880); and the number has not much increased since that time, owing to this race being ill adapted, from its chivalrous, confiding, and improvident character, to the requirements of the present time.

The West Caucasian group of languages contains the idioms used by Abkhasian, Abasian, and by different Circassian and Kabardic tribes, inhabiting the western part of the main Caucasian range. The most prominent authorities concerning this linguistic group are George Rosen[4]

[1] Bopp, *Kaukasische Glieder des Indo-Europeischen Sprachstamms*, Berlin, 1847.

[2] Zagarelly, *Examen de la littérature relatif à la Grammaire géorgienne*, St. Petersburg.

[3] *Petermann's Geogr. Mitteilungen*, 1880, Heft ix., "Ethographie des Kaukasus."

[4] Rosen, *Ueber Swanetische u. Abchasische*, Berlin, 1845.

(of the Academy of Berlin), and Baron Uslar, who studied it on the spot a quarter of a century ago, with the assistance of some of the indigenes. Abkhasian, in common with Basque and Indio-American, belongs to those very imperfectly developed languages called agglutinative. There are many Abkhasian tribes whose language or dialects differ more or less widely, viz. :—Abasy or Baschog, Barakay, Bag, Schegeray, Kisilback, Bashilbay, and Oubikh. The language spoken by the last has already disappeared from the Caucasus, but Baron Uslar was in time to investigate it, and he came to the conclusion that it is one of the idioms (or dialects) of the Abkhasian family of languages. Mr. Sagursky, who has followed at some distance in the steps of the learned Baron, possesses some unpublished notices on the language of the Oubikh, and in his very valuable memoir on the investigation of Caucasian languages, from which I have gleaned much in the present sketch,[1] he says that he is quite ready to deliver these notes to any one who would undertake the study of Oubikh—a dying language, which is still perhaps spoken at the present day by a few Oubikhs dispersed in Asiatic Turkey. It is to be regretted that so generous an offer should have been neglected. Baron Uslar has composed a small Abkhasian vocabulary, which proved very useful in some Abkhasian schools. Besides Rosen, whom I have mentioned, and whose notices on Abazes or Abadzéghé are to be found in the memoirs of the Academy at Berlin (1845), there are also Sjoegren and Vivean S. Martin, whose works on the same subject deserve attention.[2]

Another family of languages in the western Caucasus—which was supposed by Klaproth, Erckhert, Friedrich Müller, and Vivien de S. Martin to be nearly related to the Abkhasian, and which stands, perhaps, in a more independent position towards it—is the Circassian or Tcherkasian. In the case of the following Circassian tribes the idioms are not quite identical, viz., Kabertay or Kabardy, Besleney, Kemgui or Temergoi, Egerukoi, Chatukai, Machosch, Jan, Abadsach, Schapsuch, Bseduch-Chamysch, Bseduch-Tschetschen, Notukhai or Notchuadze. The first known work on the Circassian language is that of Lulié, which has been approved by the St. Petersburg Academy of Science, and was published in 1876. It is a Russo-Circassian vocabulary, with a short grammar of Circassian. Mr. Sagursky, in his notice, speaks disparagingly of this work. According to him, it does not throw much light on the Circassian language, nor does it make a distinction between various Circassian dialects, or explain which is the dialect made use of in the vocabulary for the interpretation of Russian words; and, besides this, it gives no idea of the phonetics of Circassian. An earlier, and perhaps worthier, work on the Circassian language, written by an intelligent native—Bekmursin-Nogmoff—has been, somehow, lost in manuscript, and has never had the chance of publication. I have observed that there exist no decisive proofs of the supposed near relationship between the Abkhasian and Circassian tongues; and, in fact, there are as yet too few materials to

[1] *Sametka ob issledovanii Kavkaskichiasykof* (supplement to vol. vi., *Isvestia of Caucasian Section of Imp. Russ. Geog. Soc.*

[2] Sjoegren, *Bull. Scient. de l'Acad. de St. Pétersbourg*, Sec. Hist., 1847, iv. p. 163; St. Martin, *Annales des Voyages*, Paris, Avril 1854.

build up any conclusions at all. Nor can the knowledge already obtained be considered as sufficient to warrant any opinion but a purely negative one as regards the question of any connection between the languages of Western Caucasia and any other known idioms in other parts of the world. According to N. de Seidlitz, there were, in 1880, 138,025 West Caucasian Highlanders, divided as follows :—Kabardyan, 66,189; Bshedduch, 15,563; Abadseh, 137,660; Schapsug, 5033; Temirgoi, 3150; Natuchai, 184; Besslenei, 5875; Eruchai, 1678; Chatukai, 606; Mamchagoi, 887; Machoshee, 1204; Chakutsch, 87; Moloshee, 235; Barakhai, 92; Bachow, 6 (all the fifteen tribes being Circassians); Abhasian (Azega) 13,209; and Abasian, 9367.[1] This number has since considerably diminished. According to the census taken by Mr. Felitzyn[2] in December, 1883, the decrease is one-half of the total number, and since then the emigration of the highlanders into Turkey has gone on steadily.

The East Caucasian group of languages embraces the idioms spoken by tribes and nationalities inhabiting Daghestan and the northern as well as the southern slopes of the Andian Mountains. All these tribes and nationalities are known under the names of Lesghin and Tschetschen. The latter occupy the country on the northern foot of the eastern Caucasus, between the upper and the middle course of the Terek; and the Lesghins are distributed in other parts of Daghestan proper. The language of the Tschetschens, whose number is now very insignificant, was investigated by Uslar, but he did not succeed in determining whether there be any notable difference between the idioms spoken by different Tschetschen tribes. According to Sagursky, there is considerable reason to presume that there exists between the small Tschetschen tribes a greater variety of dialects than between the far more numerous tribes of the Lesghian people, who call themselves Nachtsche. As a proof of this, he reminds us that the dialect of one Tschetschen tribe—Tsow—was erroneously accepted by Schiefner, who studied Tschetschen, for an independent language. Daghestan was called formerly "The Mountain of Languages," but it seems, according to the investigations by Uslar and Sagursky, that this was rather an exaggerated estimate—a true Oriental hyperbole. Baron Uslar has recognised six Lesghian dialects, which are most largely represented, viz., Avar, Lacky, Darghy, Kurin, Tabasaran, and Artchi. Mr. Sagursky afterwards gathered materials for the study of four other Lesghian dialects, viz., Rutul, Tsachur, Andi, and Kubatchy. It seems that the variety of Lesghian is pretty well exhausted by this division, though the number of Lesghian tribes is given at from 27 as a minimum, according to Komaroff,[3] to 55, according to Kalantai.[4] In his *Ethnographie des Kaukasus*, Mr. Seidlitz gives the names and numbers of the following fifteen Lesghian tribes, which list I complete by the mention of the dialects these tribes use.

[1] *Petermann's Geogr. Mittheil.* 1880, Heft ix., with an ethnographical map.

[2] *Isvestia of Cauc. Sec. Imp. Russ. Geo. Soc.*, vol. viii., 1887.

[3] *Sapisky of the Cauc. Sec. Imp. Russ. Geogr. Soc.*, vol. viii., 1873.

[4] Foutou's *La Russie dans l'Asie Mineure* distinguishes three more Lesghian dialects, viz., Dido, Akucha, Koisouboul. Schiefner mentions also Udin as a Lesghian dialect.

Names of Tribes.	Number.	Language.
Avar,	155,194	Avar (Uslar).
Andy,	35,511	Andy (Sagursky).
Dido,	9074	Dido (Foutou).
Lacky (Kasikumyeh),	35,139	Lack (Uslar).
Artschy,	592	Artschy (Uslar).
Darghy,	88,045	Darghy (Uslar). Akucha (Foutou).
Tabasaran,	16,350	Tabasaran (Uslar). Kubatchi (Sagursky).
Agul,	5357	Koisoboul (Foutou).
Kurin,	131,609	Kurin (Uslar).
Rutul,	11,803	Rutul (Sagursky).
Zachur,	4561	Zachur (Sagursky).
Dshek,	7187	undetermined.
Chinalug,	2196	undetermined.
Krys,	4795	undetermined.
Udyn,	9668	Udin (Schiefner).

Whatever may be the actual numbers of the Lesghian tribes, it is sufficiently ascertained that all the Lesghian languages—or, more properly speaking, the dialects—are more or less nearly related among themselves, and that, consequently, they must have had a common origin. It has not yet been discovered whether this separation of the original Lesghian language into dialects occurred before or after the settlement of the Lesghians in eastern Caucasia, an event which belongs to a very remote epoch of human history.[1] It would seem that the physical relief of Daghestan, divided as it is into distinct and deep valleys, very difficult of access, may have caused an estrangement between tribes formerly united, and have produced a greater variety of language. But this seems to be contrary to the current theory in philology, conformably with which Mr. Sagursky and other philologists are inclined to believe that the Lesghian language was separated into distinct dialects before the arrival of the Lesghians in Daghestan, and that formerly there was an even greater diversity of idioms than prevails now. As a proof of this hypothesis, Mr. Sagursky calls attention to the fact that there are in Daghestan some Lesghian dialects, as Avar and Darghi, more largely represented than others, which belong precisely to those nationalities which in earlier times succeeded in entering into close political union; and, probably, subjugated or assimilated some smaller tribes differing from them in language. These are, of course, only vague suppositions, presenting many obscure points. According to Renan, there is no necessary coincidence between the formation of tribes and nations and the formation of languages and dialects; the appearance of tribes and nations—or, as the learned Academician styles it, of the different species of humanity—is by many centuries anterior to the formation of languages, and the lines of division in the former and in the latter case do not at all coincide. It may perhaps have happened many a time

[1] According to Georgian chronicles, the forefather of the Caucasian aborigenes was Targamoi, the son of Tarsis, great-grandson of Noah.

that families, very nearly related from a physiological point of view, but already separated by circumstances, have formed their languages after a widely different pattern.[1] The same idea was expressed by Uslar in other terms. This great independence of language from physiological relationship, which certainly must be acknowledged, and instances of which we can easily find in the Caucasus (*e.g.*, many Armenian villages speak only Georgian), complicates the question at issue. The difficulty is not diminished by the circumstance that in Daghestan we have to deal with differences of language and dialect appertaining to one common origin.

The Lesghian languages are agglutinative, with a tendency to inflection; and, according to Sagursky, they must be added to the category of languages characterised by suffixes. As being in a state of very incomplete formation, Lesghian might serve as an admirable illustration of the successive stages of development which all European languages have certainly undergone, and which, without such aid, we can only vaguely guess at. With the exception of the Udine language, which has been strongly influenced by Tartar and Armenian, and is considered by some as related to Albanian, no relationship has been discovered between languages spoken in Daghestan and other known idioms. The efforts made by Klaproth [2] to find out some connection must be considered as without result, philology in his day being almost in its infancy. Baron Uslar, who must be considered as the foremost authority concerning the ancient languages of the Caucasian Highlanders, offers the following hypothesis in regard to their origin. The Caucasian Highlanders are at the present day the insignificant remains of many nations who in prehistoric times inhabited a vast extent of territory in Asia and Europe, and belonged to a race which has everywhere disappeared, except in the Caucasus. According to him, the Caucasus was not the passage for the immigration of nations, but a refuge for the remnant of nations who were persecuted and scattered on the plains.[3] This theory undoubtedly commands far more and far easier acceptance than the reverse; but before sufficient light can be thrown on the question at issue, it will be necessary to learn Caucasian languages far more thoroughly than they are known at the present day, and there is not much time to lose; these precious tongues, the remarkable product of the creative power of primitive nations, are fast disappearing from the earth. It was a powerful and unerring instinct to express most properly in words the impressions made on our inner self by the outer world that guided our forefathers in the formation of language. We have lost the vividness of first impressions, and with it the power of creating words by instinct; we do it now by reasoning, but the weakness of words thus produced is sufficient proof of the inferiority of the modern process.

Besides the three groups of languages already mentioned—Cartvelian, Abazo-Circassian, and Lesghian—known under the name of Caucasian, because they are spoken only in the Caucasus, there are in the country

[1] Renan's *Hist. du Peuple d'Israel*, pp. 2, 3.

[2] Klaproth, *Ethnologie Générale et la Géographie des Provinces des Kour*, 1811.

[3] *Sapisky of the Caucus. Sec. Imp. Russ. Geog. Soc.*, vol. vii.

many other languages which are sufficiently known beyond the frontier. Of such there are five which are most widely spread among the Caucasian population, viz., Armenian, Persian or Iran, Kurd, Ossetin, and Tartar (Adzerbeidjan).

The most eminent authority on Armenian is Dulaurier, whose work, *Exposé des progrès recents et de l'état actuel des études arméniennes en France*, embodies an extensive knowledge of the position of this language in the family of languages constituting the object of comparative philology. Linguistic researches in Armenian date back to the appearance of the work of Professor Petermann in 1837. Somewhat later, Fr. Müller advanced the opinion that Armenian belongs to the Iranian family, but that it is to be considered not as a near relation either of Old-Persian or of Old-Bactrian, but as the descendant of another primary idiom, which is lost to us, and which constituted with these two ancient languages of Iran a trilogy of fundamental speech. This view was, however, seriously challenged by Professor Patkanoff, who thus sums up his conclusions in regard to the origin of Armenian: Armenian occupies a middle place between the Iranian and the Letto-Slav groups, and is the representative of an independent group of Indo-European languages which has disappeared.[1] It is necessary to make a distinction between literary and popular Armenian. The first was employed by ancient writers of the literary centuries of Armenian history, and is now a dead language, though there are not wanting efforts on the part of modern Armenian writers to revive some of the disused words of their ancient literature. The popular or vulgar Armenian is the vernacular tongue spoken by Armenians of the present day, either in Armenia proper, or elsewhere. There are two principal divisions of the Armenian language, viz.:—Western and Eastern, which in their turn are divided into sub-dialects. Western Armenian is spoken in the Turkish provinces and the Crimea; Eastern Armenian has its seat in Transcaucasia, Southern Russia, Persia, and India. Professor Patkanoff distinguishes twelve Armenian dialects, some of which—as, for instance, the Ararat dialect—have almost the independence and dignity of separate languages, whilst others nearly resemble one another. Professor Dulaurier estimates very highly the literary importance of Armenian. "Armenian," he says, "like Greek, is one of the most vigorous and best constituted branches of the Indo-European *tronc*. It rivals Greek in the flexibility and variety of its phraseological structure, the plenitude of its expressions, and its unlimited power of creating derived and compound words." This estimation sounds very high; and it is perhaps due partly to Mr. Dulaurier, as also to certain intelligent Armenians,[2] that there has arisen amongst the Armenian population of Transcaucasia a revival of attachment to and interest in their native language, which was shamefully neglected by the educated classes in the first half of the present century. According to Seidlitz, the number of Armenians in Cis- and Trans-Caucasia was, in 1880, 721,243 souls; and this number has undoubtedly

[1] *Isvestia of the Caucas. Sec. Imp. Russ. Gog. Soc.*, vol. vi., part 1.

[2] There are not wanting efforts on the part of these Armenians to make their literature known in Europe. See *Armenische Bibliothèque*, Leipzig, edited by Abgar Johannisiantz.

increased since, as the Armenians constitute the majority of the well-to-do population in this country. According to the statistical tables of Behm (*Die Bevölkerung der Erde*), the whole Armenian population of the globe numbered in 1873, 1,906,000 souls, and is probably above two millions at the present day.

The Iran or Persian language in the Caucasus is represented by the dialects Táty or Tadjik in Baku, and by Talyshy in Lenkoran. Táty was partly investigated by Bérésin;[1] it is a modification, or rather a corruption, of modern Persian. Alexander Chodsko, the author of *Specimens of the Popular Poetry of Persia*, has taken more trouble to throw light on these Persian dialects. According to him the Talyshy has preserved better than any other Persian dialect the traces of Zend. Generally the inhabitants of the South Caspian shores, protected as they are from Persia by the mountain chain of Elburz, have withstood foreign influence better than their neighbours, who are not isolated through difficulty of access. A short grammatical sketch of Talyshy was made by Mr. Riss,[2] but the exact position of this dialect, having considerable similarity with Modern Persia, is not settled. According to Seidlitz, there are in Transcaucasia 81,490 people speaking Táty, and 42,999 people using Talyshy.

There exists far less doubt as to the independent position of the Kurmanjee language spoken by the Kurds, a pastoral people of patriarchal type. The Kurds formerly inhabited Media, and are now widely dispersed on the confines of Transcaucasia—with Persia and Turkey towards the north-east limits of Chorossan on one side, and the mountains of Suleiman, in Asia Minor, on the other. The isolated life of the Kurdish tribes has favoured the formation amongst them of a considerable number of distinct dialects, of which Kermanjee, divided into many sub-dialects, is considered as the principal. According to Lerch,[3] the Kurds speak five principal dialects, which, besides these just mentioned, are :—Zâzâ, Loûr, Kelhoûr, and Gûran. According to Sagursky,[4] all Kurdish dialects belong to one language—Kermanjee, and resemble one another very closely, with the sole exception of Zâzâ, which is used in the valley of Muradtschai, and in the neighbourhood of Mucha and Palû. The investigations in Kermanjee began more than a century ago with the work of Father Gargoni (*Grammatica della Lingua Curda*), but these, as all subsequent studies (among which, as most deserving, are those of Lerch, Alex. Chodsko,[5] A. Yaba,[6] A. Clement,[7] Taylor,[8] Bérésin,[9] Rea[10]), do not command our complete confidence, for they present many discrepancies between themselves, and there are numerous ambiguities in the transcriptions

[1] Bérésin, *Recherches sur les Dialectes persans*, 1853.
[2] *Sapisky of the Cauc. Sec. Imp. Russ. Geog. Soc.*, vol. viii.
[3] Lerch, *Forschungen über die Kurden*, St. Petersburg, 1858.
[4] *Isvestia of the Cauc. Sec. Imp. Russ. Geog. Soc.*, vol. vi.
[5] *Specimens of the Popular Poetry of Persia.*
[6] *Recueil des Notices et Recits Kourdes*, St. Petersburg, 1860.
[7] *Excursion dans le Kurdistan* (*Le Globe*, vol. v., Genève).
[8] *Journal Roy. Geog. Soc.*, vol. xxxv., 1865, and vol. xxxviii.
[9] *Recherches sur les Dialectes persans*, St. Petersburg.
[10] *Brief Grammar and Vocabulary of the Kurd Language.*

of the same words and meanings. According to Mr. Sagursky, who prepared a short grammatical sketch of one Kurd dialect, his predecessors placed too great reliance on their auditory faculties, which are very deceptive, and they have not duly acknowledged, in their study of Kermanjee, the importance of prefixes and suffixes, which, with the extreme simplicity of grammatical forms, constitute precisely the key to the right understanding of this language. Mr. Sagursky studied the language, with the assistance of a native Kurd (Mr. Egiasaroff), and for the transcription of words, instead of the Arabian alphabet, which is so poor in vowels, he employed an alphabet nearly approaching that of Castrén, which has proved so useful in the works of Schiefner. The investigations made by Sagursky into only one Kurd dialect, however, do not enable us to understand the origin of Kermanjee, which in consequence remains very imperfectly known, to the considerable loss not only of philology but also of the general interests of civilisation. Kurds are quite capable of engaging in any useful calling; but they remain rude and dangerous in consequence of their ignorance and isolation. They are everywhere divided into numerous tribes. The number of Kurds in Transcaucasia is given by Mr. Seidlitz as amounting to 44,485 souls (1880). The number of Kurds in the three adjoining States—Russia, Persia, and Turkey—is probably not less than two millions.

To the Iranian group of the Aryan family of languages spoken in Caucasus, we must also add Ossetin, which is used by an ancient people calling themselves Iron, and is known as Ossets. These people settled, in prehistoric times, on both slopes of the famous Dariel Pass, in the central part of the main chain, in the countries called Tagouria and Digoria. They have been the object of many ethnographical inquiries, and have given rise to strange and hazardous guesses as to their origin. The difficult questions arising out of the nature of the Ossetin language were finally settled by Sjoegren (S. Petersb. Academy), who had studied this language with the assistance of the indigenes, and thereby succeeded in explaining and making clear its phonetic peculiarities, and in constructing a grammar and vocabulary. Thanks to the inquiries of Sjoegren, it became for the first time possible (as in the case of Baron Uslar in Daghestan) to open schools among the Ossets, and to translate some of the Christian prayers into their native tongue. This work has already borne good fruit. Sjoegren has proved that Ossetin belongs to the Iranian group of Aryan languages, and that it is older than Modern Persian and its idioms. It has two dialects—Tagour and Digor—both of which were investigated and classified by Sjoegren, and, later, by Dr. Pfaff. There are about 120,000 Ossets in Cis- and Trans-Caucasia, and not above one million, as Colonel Yule erroneously stated in his paper read in London at the Royal Asiatic Society on the 19th of March last. They are a peaceful people; are not addicted to brigandage; and were converted to Christianity long ago, but retain most of its old superstitions.

Besides the nationalities and tribes whose names I have mentioned, there exist also in the Caucasus a considerable number of Asiatic and European peoples sufficiently known beyond the Caucasian frontiers. According to statistics, the actual population of the Caucasian Lieutenancy

of about six millions can be divided into fourteen or fifteen different races, which constitute not less than eighty distinct nationalities, without taking into account a far greater number of tribes. The Caucasian aborigines—such as Georgian, Armenian, Kurdish, Lesghian, Ossets, and other highlanders—constitute almost one-half of the entire population, the other half being equally divided between Asiatic and European races.

The highly interesting and complicated question of whence all this diversity of nationality and language in the Caucasus resulted, and in what way it came about, has occupied many scientists, and especially Baron Uslar, who, of all philologists, has acquired the largest practical knowledge of the Caucasian languages, and has expressed his views and facts concerning the ancient history of the Caucasus in his great work entitled *Drevneischia Skasania o Kavkase* ("The Most Ancient Narratives concerning the Caucasus").[1] He has advanced in this work the hypothesis regarding the origin of language which resembles in many respects that published quite recently by Regnaud, Professor of Sanscrit in Lyons, in his work *Origine et Philosophie du Langage*. It is quite impossible for me, in this short and imperfect sketch, to enter into the particulars of so vast a question, which was not only raised but also partly solved by Baron Uslar; and I can do no better for the satisfaction of the reader, who has had the patience to follow me thus far, than to conclude my remarks by expressing a hearty desire that this work of the Caucasian savant, who has so greatly contributed to the knowledge of so many unknown idioms—the highest product of the intellectual activity of quite as many unknown nations —should be translated into English, and be thus more largely known and better appreciated than it is at present.

THE EAST CENTRAL AFRICAN QUESTION.

Read at Meeting of Society, Edinburgh, 14th May 1888.

By Arthur Silva White, F.R.S.E.,

Secretary to the Royal Scottish Geographical Society.

The question which has arisen in East Central Africa, as regards the safety and prosperity of our missionaries and traders in the Lakes Region and the Shiré Highlands, may be treated apart from the larger issues at stake in considering the whole continent as a field for commercial enterprise and philanthropic effort. In my recent paper on "The Partition of Central Africa" (vol. iv. p. 152), I ventured to call the attention of the Society to the action of European Powers and private associations in partitioning off all the unclaimed lands into "spheres of influence." The maps which accompanied this paper were intended only as provisional: they served their purpose for the time; and, I hope, on some future occasion, when rival claims have been adjusted, to give a more accurate delimitation of the territories possessed by the European Powers.

[1] It forms volume xii. of *Sapiski of the Cauc. Sec. Imp. Russ. Geog. Soc.*, 1881.

In the meantime, whilst the larger question at issue must remain "under consideration," that in regard to Nyassa Land has recently been asked and partly answered. If the answer is not altogether a satisfactory one, it is at least reassuring. Her Majesty's Government are prepared to interfere on behalf of our missionaries and traders to the extent of their power, and as far as international obligations will admit; they will not go back from their engagements with friendly Powers, but they recognise their responsibility in safeguarding the interests of British subjects. I can conceive that those whose interests are bound up in East Central Africa may think that Her Majesty's Government are willing to take only half measures, but it should be borne in mind that responsibilities incurred on behalf of the nation must be restricted to those involving national interests.

The East Central African Question may be briefly stated under the following heads:—

I. Portugal on the East Coast of Africa.—Although the Portuguese have been established on the Sofala and Mozambique coasts for centuries, they have taken no practical steps to develop the country or to check the slave-trade. Portugal has, however, been obliged to declare the holding of slaves within her territories as illegal. She has held the East Coast and the Lower Zambesi at a few isolated spots as penal settlements, the administration of which has shown a heavy annual deficit. No Portuguese travellers, previous to Serpa Pinto and Cardoso (1885), explored the interior. The action of Portugal on the East Coast and in the Zambesi region has, in short, tended to cripple commerce and native emancipation. In the words of Dr. Livingstone: "The Portuguese pretence to dominion is the curse of the Negro race on the East Coast of Africa, and it would soon fall to the ground were it not for the moral support it derives from the respect paid to it by our own flag." Dr. Livingstone adds: "Only by the aid of English sailors has the Government of Mozambique, on more than one occasion, been saved from being overturned."

II. British Zambesi Expedition.—About thirty years ago the British Government despatched an expedition under Dr. Livingstone, with the object of opening up the interior of Africa by the highway of the Zambesi, and of introducing legitimate commerce. Dr. Livingstone thus refers to the expedition:—

"The main object of the Zambesi Expedition, as our instructions from Her Majesty's Government explicitly stated, was to extend the knowledge already attained of the geography and mineral and agricultural resources of Eastern and Central Africa, to improve our acquaintance with the inhabitants, and to endeavour to engage them to apply themselves to industrial pursuits and to the cultivation of their lands, with a view to the production of raw material to be exported to England in return for British manufactures; and it was hoped that, by encouraging the natives to occupy themselves in the development of the resources of the country, a considerable advance might be made towards the extinction of the slave-trade, as they would not be long in discovering that the former would eventually be

a more certain source of profit than the latter. The expedition was sent in accordance with the settled policy of the English Government ; and the Earl of Clarendon being then at the head of the Foreign Office, the mission was organised under his immediate care. When a change of Government ensued, we experienced the same generous countenance and sympathy from the Earl of Malmesbury, as we had previously received from Lord Clarendon ; and, on the accession of Earl Russell to the high office he has so long filled, we were always favoured with equally ready attention and the same prompt assistance. Thus the conviction was produced that our work embodied the principles not of any one party, but of the hearts of the statesmen and people of England generally.

"Though collections were made, it was always distinctly understood that however desirable these and our explorations might be, Her Majesty's Government attached more importance to the moral influence that might be exerted on the minds of the natives by a well-regulated and orderly household of Europeans, setting an example of consistent, moral conduct to all who might witness it, treating the people with kindness and relieving their wants, teaching them to make experiments in agriculture, explaining to them the more simple arts, imparting to them religious instruction, as far as they are capable of receiving it, and inculcating peace and goodwill to each other." [1]

This expedition was undertaken with the full concurrence of Portugal ; it cost British tax-payers £30,000, exclusive of the cost of the s.s. *Pioneer*, and of the *Lady Nyassa* which Livingstone himself purchased for £7000.

The Earl of Clarendon, in a despatch written to Sekeletu (who, at that time, was considered the paramount chief on the Zambesi), which was sent by the hands of Livingstone, said :—

"Ours is a great commercial and Christian nation, and we desire to live in peace with all men. We wish others to sleep soundly as well as ourselves : and we hate the trade in slaves. We are the children of one common Father ; and the slave-trade being hateful to Him, we give you a proof of our desire to promote your prosperity by joining you in the attempt to open up your country to peaceful commerce. With this view *the Queen sends a small steam-vessel to sail along the river Zambesi, which you know and agreed to be the best pathway for conveying merchandise, and for the purpose of exploring which Dr. Livingstone left you the last time. This is, as all men know, 'God's pathway' ; and you will, we trust, do all that you can to keep it a free pathway for all nations, and let no one be molested when travelling on the river.*

"We are a manufacturing people, and make all the articles which you see and hear of as coming from the white men. We purchase cotton, and make it into cloth ; and if you will cultivate cotton and other articles, we are willing to buy them. No matter how much you may produce, our people will purchase it all. Let it be known among all your people, and among all the surrounding tribes, that the English are the friends and promoters of all lawful commerce, but that they are the enemies of the slave-trade and slave-hunting."

This despatch is held by our missionaries and traders as a direct invitation from Her Majesty's Government to open up to civilisation by British enterprise the Lakes Region of Africa by way of the Zambesi. It must, however, be borne in mind that, at the time this despatch was

[1] *The Zambesi and its Tributaries*, p. 9.

written (February 1858) public opinion in this country was excited to the utmost by the deeds and discoveries of Livingstone, and the interest of other European Powers (including Portugal) in Africa was of no account. The expedition was recalled mainly for financial reasons.

III. Results of the Zambesi Expedition.—The expedition succeeded in its object. It discovered the Shiré route and Lake Nyassa, and it investigated the causes and results of the slave-trade at its sources. The Portuguese at that time were quite ignorant of the geography of the region traversed by the expedition.

IV. Subsequent British Explorations and Discoveries.—Dr. Livingstone, in a subsequent expedition, unaided and alone, discovered Lakes Bangweolo and Moero, and the head-waters of the Upper Congo (Lualaba), and fixed the true orientation of Lake Tanganyika. Thomson, Consul O'Neill, and other British explorers, have assisted in mapping out and making known the Lakes Region of Africa. No Portuguese travellers have added to their knowledge.

V. British Occupation of the Lakes Region.—In obedience to the last wishes of Livingstone, our countrymen established the African Lakes Company, Limited (Glasgow), and took up the work he had initiated, and for which he died; and British Missions sprang up in his track. British subjects have thus invested large sums of money in developing the resources of the Lakes Region, and have freely given their lives in the cause of native emancipation. No other nation has laboured in the same field. According to official estimates, no less a sum than £400,000 has been thus expended. The Zambesi Expedition cost over £30,000; the Scottish Missions have expended some £100,000; the English Universities Mission about £50,000; the Commercial Companies some £200,000; and the balance of £20,000 is probably not in excess of the expenditure of private individuals in these parts. The Scottish Churches have 50 representatives in actual and lawful occupation of land, the English Universities Mission some 18 representatives, and the African Lakes Company over 25. The Church of Scotland has its centre of operations at Blantyre; the Free Church of Scotland in Nyassa Land; the English Universities Mission, with its headquarters at Zanzibar, joins the Missions on the Lakes; Messrs. Buchanan Brothers have plantations at Zomba (where the British Consulate is situated); and the African Lakes Company have stations throughout the entire Lakes route, from the coast to the southern shores of Tanganyika. The Scottish Churches have been at work there for twelve years, and the English Universities Mission for twenty-six years. A British Consul is attached to Nyassa.

The result of these agencies has been (1) to open up a fine route into Central Africa; (2) to create legitimate commerce, and to employ native labour; (3) to ameliorate the condition of the natives; and (4) to check the slave-trade, tribal wars, and barbarous practices.

VI. Portuguese Action.—Portugal, though she has done nothing to bring about the better state of affairs in the Lakes Region, has benefited by her possession of the Zambesi mouths, since the only practical route to the Lakes is by this entrance. The *ad valorem* import duty, up to within quite recently, was 3 per cent.; though the treaty of February 26, 1884, was never ratified. Portugal has now raised the tariff to 10 per cent., without showing in justification any commensurate or increased facilities to her customers. She has announced that in future only vessels owned and manned by Portuguese subjects shall be permitted to navigate the Zambesi; though it is understood that this restriction is now withdrawn. She lately seized the *James Stevenson*, a stern-wheel steamer belonging to the African Lakes Company; but, in consequence of the diplomatic intervention of Her Majesty's Government, she has restored the vessel to her owners. I conclude that Portugal will in future abstain from further action of this sort, since the Marquis of Salisbury, in his letter to the Council of the Royal Scottish Geographical Society (*see* Appendix), says that "Her Majesty's Government have already succeeded in obtaining a promise from the Portuguese Government that vessels now navigating the Zambesi shall not be interfered with."

VII. German Action.—Germany has lately acquired an immense sphere of influence on the East Coast, and has established a Protectorate over the territories of Usagara, Useguha, Nguru, and Ukami, which are situated within this sphere of influence. Its western limit, as defined by the London Convention, is shown on the maps published with the March (1888) number of our Magazine. It stops short of Lake Nyassa, at the confluence of the Msinje with the Rovuma, from which point it extends in a direct line to near Kavirondo, on the Victoria Nyanza. It will thus be seen that German interests are made to stop short of the Lakes. German influence at Zanzibar, however, would appear at the present time to be paramount. I understand that Germany has had her agreement with the late Sultan ratified by his successor. She has sent out missionaries and explorers, is establishing plantations, and appears to be earnest in her efforts at colonisation. Germany, however, is too young a colonial power, and has not the means, to check the slave-trade, though her co-operation as a Christian State must always be relied upon.

VIII. Combined Action of Germany and Portugal.—Germany and Portugal, without reference to Great Britain, have divided the Lakes Region between them. (See "Partition of Central Africa," vol. iv. p. 152.) It is clear, from the terms of their mutual agreement, that neither intend to act on the Lakes, in a political sense. Should this surmise prove correct, and should British enterprise thereby be checked, it is evident that the relapse of the Lakes Region into its former state of barbarism would be a question of time only.

IX. British and German Diplomatic Engagements.—In view of the unexpected vigorous colonising movement of Germany on the East

Coast, it is to be regretted that British interests have not sooner been made the subject of diplomatic representation. Unfortunately, our Foreign Office has entered into a distinct engagement with Germany, as regards the limit of our sphere of influence on the East Coast, which raises a fresh barrier against British claims to the Lakes Region. In the exchange of Identic Notes between the Earl of Iddesleigh and Count Hatzfeldt (Blue Book, Africa, No. 3, 1887), the following passage occurs:—"Great Britain engages not to make acquisitions of territory, accept Protectorates, or interfere with the extension of German interests to the south of this line [viz. line of demarcation between British and German spheres of influence on the Zanzibar coast]; and Germany makes the same engagement as regards the territories to the north of this line." Whether "south of this line" includes the Lakes is not at all clear; but if it does, British interest must stop at the German-Portuguese boundary on the Nyassa.

X. The Recent Disturbances in Nyassa Land.—Our missionaries and traders on the north of the Nyassa have recently sustained what would appear to be a concerted invasion of the slave-traders. These enemies of civilisation and legitimate commerce are conveniently called "Arabs," but a gentleman who took part in the attack on the "Arab" stronghold (Dr. Tomory) assures me that there were not more than four or five Arabs among them: they were composed of the sweepings from the coast—Zanzibaris, Swahelis, and Rovuma men. However this may be, it is clear that they settled on the north of the Nyassa, as far as the watershed dividing this lake from Tanganyika, instigated a quarrel with the Wa-Nkonde natives, and, in the disturbances that ensued, butchered the Wa-Nkonde and destroyed their villages, attacking also the African Lakes Station at Karonga. Here they were held in check by our countrymen, who had intrenched themselves within a stockade, and subsequently turned the attack against them. Our space will not admit of even a bare summary of these events. We have alluded to them (vol. iv. p. 163) in the Magazine, and the newspapers have given ample details. The most recent news (27th April 1888) received by the African Lakes Company states that a fresh attack is anticipated. That there has been a fresh impulse to the traffic in slaves in this region cannot be denied, and it has been asserted that the seat of this mischief is to be found in Zanzibar itself. The slave-trade cannot be carried on without guns and ammunition, and we are assured that these have been regularly supplied from Zanzibar. The Lakes Route, so called, is now temporarily closed, nor can it be reopened and secured to European settlement until the present difficulties are swept away. Our missionaries and traders are in danger of losing their lives and property, and the natives are threatened with extermination or enforced slavery.

XI. The Slave-Trade.—The British Government at one time spent £70,000 on arresting the slave-trade on the East Coast of Africa, and her squadron is still active in this service to humanity. A glance at the map prepared by Mr. James Stevenson of Largs, who has himself brought

up to date the Slave-trade Map originally constructed for him by Mr. E. G. Ravenstein, will show that the caravan routes ordinarily used by the slave-traders in this region are all intersected by the Lakes Route. We know how futile it is to hope to check the slave-trade by watching the coasts. A single gun-boat or fortified steamer on the Nyassa (not to speak of Tanganyika) would be more effective, in conjunction with the operations of the trading companies and missions, in stamping out the slave-trade at its sources than the most vigilant squadron on the coast. This is no new solution of the question. Dr. Livingstone, writing on this subject twenty-eight years ago, said:—"By means of a small steamer, purchasing the ivory of the lake and river above the cataracts, which together have a shore-line of at least 600 miles, the slave-trade in this quarter (Nyassa Region) would be rendered unprofitable; for it is only by the ivory being carried by the slaves that the latter do not eat up all the profits of a trip. . . . It is only by cutting off the supplies in the interior that we can arrest the slave-trade on the coast. . . . The slave-trade, like every other branch of commerce, is subject to the law of supply and demand." The slave-trade in itself does not pay: only about one-fifth of the victims, who escape slaughter from the attacks made on them by the slave-raiders, and are led away in captivity, ever reach the coast, and it is not worth taking them there for sale unless they carry the ivory, which is the chief support of the slave-trade as a commercial venture.

XII. Summing up the question, we perceive:—

(*a*) That the Lakes Region of Africa has been discovered and developed mainly by British means and British lives.

(*b*) That European enterprise on the Lakes depends for its maintenance on an easy access by way of the Zambesi.

(*c*) That Portugal, who has done nothing to explore or develop the Lakes Region, but has profited by the labours of others, by placing obstacles in the way of the free navigation of the Zambesi, cripples commerce, checks commercial and missionary enterprise, and withdraws from others the means of protecting themselves, their property, and the natives whom they are endeavouring to shield and elevate.

(*d*) That Germany is powerless to intervene effectively, and that Portugal has, judging from the past 300 years, no intention of doing so.

(*e*) That if our missionaries and traders were obliged to withdraw even partially from the scene of their long and earnest labours, the Lakes Region of Africa would relapse in course of time, unless others took up their work, into its former state of barbarism and misery.

It is therefore clear, from the above considerations, that there need be no grounds for dispute with Germany, but that Great Britain has title-deeds to Nyassa Land which no other Power can show; and that Portugal, although she holds the coast, possesses no right or powers to close the interior of Africa to its legitimate and lawful owners. Whether Great Britain, in order to secure her rights, should accept the responsibilities that

would be involved in declaring Nyassa Land, from the Ruo northwards, as a sphere of British influence, is another matter. A "sphere of influence" is not necessarily a Protectorate, though it may lead to one. It means simply that, within a prescribed district no other Power shall make acquisitions of territory, accept a Protectorate, or compete in commercial pursuits. As an illustration of this, we see on the East Coast a German Protectorate (Usagara, etc.) *within* a German sphere of influence.

My opinion is, that should Her Majesty's Government be debarred from declaring Nyassa Land a British sphere of influence, the interests of British missions and commerce there would be greatly supported by claiming the free navigation of the Zambesi to the flags of all nations. To such an arrangement Germany doubtless would be ready to agree. If Her Majesty's Government were unable to substantiate our claims on the free navigation of the Zambesi, in consequence of our interests in Nyassa Land, there is still another way to secure it. Sooner or later our possessions in South Africa will include the territories of Khame and Lobengula, and thus find their northern limit on the banks of the Zambesi. I have pointed out elsewhere that our commerce in South Africa has an inevitable extension northwards, and, as Mr. Mackenzie claims, the natural northern boundary of our possessions is the Zambesi. Khame has already given his consent to being placed under British protection, and the consent of Lobengula has, I understand, also been obtained. It is therefore only a question of time; and probably we shall soon hear of the northern boundary of our possessions in South Africa being drawn at the Zambesi River. Germany and Portugal, it is true, have advanced their claims to this unattached territory: Germany from Damara-land and Portugal from Sofala have made a feint of joining hands at the Victoria Falls, on the Zambesi (see *Scottish Geographical Magazine* for March 1888: "Claims" Map); and, if they relinquish their pretensions in these parts, it is not improbable they may demand compensation in the Lakes Region. But German claims might be satisfied, and Portuguese claims should be overlooked, in securing the free navigation of the Zambesi to the flags of all nations. By thus proclaiming the Lakes Region a free-trade area, or No-man's Land, the limits of the Congo Independent State might be extended so as to include it. Such an arrangement, however, would be scarcely satisfactory; and it is still hoped that Her Majesty's Government may see their way to securing, in spite of diplomatic engagements, the whole of Nyassa Land or the Lakes Region, from the Ruo northwards, as a sphere of British influence.

As regards the slave-trade, it cannot be doubted that prompt and vigorous measures must be taken to keep it within bounds, and that the most effective would be to arrange for a gunboat to be placed on the Nyassa. The British Consul on the lake is empowered to use only moral force, but unless he has some substantial physical power behind his back (such as a small Consular police) and a vessel of his own, he cannot be expected to have the influence he might otherwise exercise. If, on the other hand, our Government refuse to take action, the same results might be obtained by granting a

Royal Charter to the African Lakes Company. If the Company is to exist at all, and our Missions to flourish, on the Lakes, it is evident that some strong guarantee of their independent position must be furnished to them.

At the same time it must not be forgotten that Her Majesty's Government could not enter this region except at considerable expense to British taxpayers, nor could the honour of the British flag be exposed by them to reverses against which only an efficient Government administration could guarantee protection; whereas the same national responsibilities would not be incurred by a trading company. Hence it is clear that our traders and missionaries must themselves, failing Government support, take up a firm position of defence against all comers.

By request of the Society's Council, I attended, as their representative, the influential public meeting which had been convened by the Scottish Missions for the discussion of this question in London, on 24th April last; and, in company with Mr. William C. Smith, member of Council, joined the deputation to Lord Salisbury on Friday the 27th April.

The resolution, as finally agreed to and adopted by the meeting, ran as follows:—

"(1) To secure free or favourable transit for British goods in British vessels from the coast into the interior; (2) To impress on the Government facts as to the increase of the slave-trade in connection with political changes in Zanzibar, and to take such action as may be required to check the slave-trade; and (3) To take what measures seem best to them to secure the safety of British subjects and British interests in Nyassa Land." The third and last clause originally read "to declare Nyassa Land from the Ruo northwards a sphere of British influence;" but it was altered to a less definite demand to satisfy the objections of certain Members of Parliament who were ignorant of the exact meaning of the term "sphere of influence," and had not the time to remain at the meeting in order to be instructed. It is to be regretted that the conclusion of the Conference was so hurried, because, although the first two clauses have partly been secured, the last and most important clause will have to be defended on other and less important platforms.

The Society has taken up this question on national grounds, and earnestly hopes for an early and satisfactory solution, by which the Lakes Region of Africa will once more be thrown open to the civilising agencies that, up to the present time, have done such excellent work.

On the conclusion of the Paper,

Dr. J. Kay Tomory said:—

In regard to what Mr. Silva White has said as to Portuguese possessions on the coast, I should merely wish to emphasise the fact that their authority does not extend any distance inland—in fact, in some cases they cannot with any degree of safety leave the islands for the adjoining mainland except they go in strong force. Their tariff arrangements are very elastic. Nominally an *ad valorem* duty of from 3 to 10 per cent. is imposed, but on some articles as much as

30 per cent. is charged. Their presence there is simply an example of the "dog-in-the-manger policy," as far as the interior is concerned.

With reference to the now historic siege of Karonga, I only wish to state that, in my opinion, had it not been for the extraordinary influence of the Rev. Mr. Bain of the Free Church Mission, and Mr. Monteith of the African Lakes Company, over the natives, we should never have escaped from Karonga alive.

After leaving Karonga on the 29th November we were engaged first in "removing" the village at Kanyole, about 25 miles north of Karonga, the inhabitants of which had proved friendly to the Arabs; and we suspected that the latter would make this place a base of operations against us, our new camp being only 10 miles distant. On the 9th of December reinforcements arrived, including Captain Hawes, H. M. Consul for Nyassa. It was decided then that we should again invoke the aid of the natives who had relieved the siege, and accordingly Captain Hawes and Mr. Monteith went to the various chiefs and obtained their consent. A little delay occurred owing to the death of one of the said chiefs, but on December 22d we started to attack the Arab position at Mlozi's village, 12 miles inland from Karonga. The natives here showed how utterly undisciplined they were, for while we drove back the Arabs from their stockade they were engaged in looting ivory, cloth, etc. We returned to our camp satisfied that only with a much stronger European force could we effect any permanent good.

Such is the present position of affairs in East Central Africa, and I consider that the question is now a political one, and therefore any measures that are taken must be taken by the British Government, and by the people of this country. Is the work for which Livingstone died to be abandoned to that curse of Africa—the slave-hunting Arabs? Are we to withdraw from a soil enriched by British money and British lives also?

In regard to the improved state of the country I may affirm that much has been done. Let me give one example: mails are now received at Lake Tanganyika in 2½ months after leaving England, and caravans often come from Zanzibar to Ujiji in three months, under sole charge of a Zanzibari.

As regards commerce, I shall only say two or three words. The uncertainty of labour is the chief drawback, and has become quite a problem. The solution, I believe, has been found by the Mozambique Produce Company, Limited, who have established themselves at the head of the Kwakwa River (80 miles from the coast). They have introduced over fifty coolies from India under the superintendence of a thoroughly trained Parsee agriculturist. In time the natives may learn to work regularly, but at present they certainly cannot be relied on.

In conclusion, let me say that from the health point of view the route by the Zambesi and Shiré is *the* route to the Central African Lakes, and when properly developed will no doubt be very extensively used by the various settlers in those regions.

Mr. EWING, Secretary to the African Lakes Company (Limited), said:—

I am sure that we have all listened with interest to the remarks which have been made by Dr. Tomory, and while we will all join warmly in our thanks to Messrs. Bain and Monteith for their action in the defence of Karonga (which they have so nobly merited), I think that one of the first duties of a meeting such as this will be to accord also to Dr. Tomory our thanks for the part which he himself has taken in the gallant defence of that station.

The political position of East Central Africa is a very complicated one. It is difficult to define exactly the precise limits or bearings of the treaties which have been made between England and Germany on the one hand, and Germany and Portugal on the other. Indeed, it may be questioned whether those who drew up those treaties can forecast or foresee the far-reaching issues of the ultimate settlement of that region, or the final evolution of the general lines roughly sketched out in the necessarily vague and general terms of these agreements. The various aspects of this question have already been laid before you by Mr. Silva White, and I would desire now to concentrate your attention upon two leading and vital points, upon which I think there can be no divergence of opinion, either in this hall or throughout our land.

You are aware that for the last ten years we have been steadily developing the resources of Nyassa Land. We were encouraged to do so by the legislation of the Mozambique tariff of 1877, which expressly stipulated that on our imports into Nyassa Land (which have to pass through the coast-strip of Portuguese territory in their transport to the interior), we should only be subjected to a transit duty of 3 per cent., and during all these years we have been freely navigating the rivers Zambesi and Shiré without let or hindrance.[1]

Now that we have developed the resources of Nyassa Land, and have invested large sums of money there, the Portuguese authorities have summarily set aside this express provision of a transit duty of 3 per cent., and are insisting on our submission to their levying much higher rates of duty. Not content with this, they suddenly arrested our stern-wheel steamer the *James Stevenson* and peremptorily placed before us the alternatives of at once selling our steamers to some Portuguese, or of becoming ourselves naturalised Portuguese subjects, and running the vessels under the Portuguese flag.

On representations being made to our Foreign Office, we received intimation from Lord Salisbury that the Portuguese Government have sent out instructions to their authorities at Quilimane to take no further action in the matter of the *James Stevenson* in the meantime. But, in reply thereto, while thanking his Lordship for having kindly secured us this respite, we have pointed out to him that we cannot consider this satisfactory as a permanent settlement, and we have earnestly urged upon him to insist upon the free navigation of the Zambesi as an international highway. In this we feel sure that his Lordship will command the support of the people of this country. Not only so, but we need no argument to convince us that, in a matter affecting so many international rights, he would have the hearty co-operation of other European Powers.

During the past few months we have all been deeply pained to learn of the recent Arab raid upon Karonga, at the north end of Lake Nyassa. We must remember, however, that when we first entered that land, we did not expect that it would be all sunshine and no showers ; and, looking back upon the years that we have been there, I think we have reason to thank God that we have enjoyed up till now so much immunity from hostile influence. We went into that country with the avowed object of exposing and of suppressing the slave-trade by peaceful intercourse and the civilising influences of legitimate trade, and we have surely reason for thankfulness that this is the first time that we have come practically into *forcible* collision with the slave-trade leaders. Furthermore, deeply to be regretted as the recent outbreak at Karonga must be,

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[1] The treaty with Portugal, signed 26th February 1884, by Lord Granville, was not ratified, and therefore never has been in force.—EDS.

its result thus far can, I think, only be looked upon as encouraging, and it ought only to add fresh energy to those who are labouring so nobly for the amelioration of our down-trodden fellow-men in Africa. We knew when we entered Africa that we must be prepared for many reverses, but on our first collision with the slave-trading influence of Central Africa the native people have rallied around us, have sought our aid, and have willingly given us theirs, whilst the slavers have been driven back, and we have gained a victory. Although, on account of want of ammunition, our people deemed it prudent to fall back upon Mandala to procure further supplies, it was only to return again ; and it will be gratifying to all here to know that we have received telegraphic information from Africa to the effect that Karonga is again occupied and defended by our people, who are now waiting instructions from home. And I am sure it will also be a satisfaction to all here to learn that instructions have gone out to re-occupy the district between Lakes Tanganyika and Nyassa, and to take such measures as may be necessary for the restoration of peace, for the defence of our stations, and for the development of the resources of that district.

The people there are a fine race, peaceful and friendly, and in our time of trouble they have shown themselves ready to render us their assistance. I am sure that the sympathy of the people of Scotland will go out to that gallant little band who are now taking up their position between the Lakes in the vanguard of African civilisation.

But what will you say when I tell you that last week we received advices from Quilimane to the effect that the supplies and ammunition which had been ordered up from Natal and Zanzibar to enable that brave little party to defend their lives and their property, had been stopped at Quilimane by the Portuguese officials there, who refused to allow them to pass through their custom-house or be sent up-country ! Nay, more, we are advised that the Portuguese authorities had even forbidden the other merchants in Quilimane to sell to us arms or ammunition. I need hardly assure you that we at once addressed Lord Salisbury, praying him most urgently to take immediate measures to secure to our fellow-countrymen at least the means and the right to defend their lives.

The Rev. J. M'Murtrie, Convener of the Church of Scotland's Foreign Mission Committee, in referring to the recent deputation to the Prime Minister, at which both he and Mr. Silva White were present, said that as it was held in private it would be unfair to divulge anything that had been stated officially, but he thought he was not betraying confidence too far in stating that the deputation came away with a feeling of hopefulness with regard to the Zambesi navigation—a hope that, in the long-run, the missions and the trading companies would not be hindered by the action of the Portuguese.

Mr. A. L. Bruce recommended, in the event of Her Majesty's Government taking no active steps, the establishment of an independent government to "Sarawak" the Lakes Region, and to organise the native tribes for their self-protection.

Mr. William C. Smith, Dr. Thomas Muir, Councillor Maclaren, Mr. W. B. Blaikie, and the Chairman, Dr. George Smith, also joined in the discussion.

APPENDIX.

The following is a copy of Memorandum drawn up by the Council of the Royal Scottish Geographical Society and submitted to the Marquis

of Salisbury, Her Majesty's Principal Secretary of State for Foreign Affairs :—

"The Council of the Royal Scottish Geographical Society would respectfully point out to Her Majesty's Government—

"That thirty years ago our countryman, David Livingstone, whose services to the cause of humanity and to African exploration had even then made his name famous throughout the civilised world, was despatched by Her Majesty's Government to the Zambesi, with the full consent of the Portuguese Government, to open up the interior of Africa to commerce through the Zambesi and its tributaries.

"In the words of the despatch written by the Earl of Clarendon to Sekeletu, the paramount Chief in the Zambesi Region, dated 19th February 1858, and sent by the hands of Livingstone—

"'Ours is a great commercial and Christian nation, and we desire to live in peace with all men. We wish others to sleep soundly as well as ourselves : and we hate the trade in slaves. We are all the children of one common Father : and the Slave-trade being hateful to Him, we give you a proof of our desire to promote your prosperity by joining you in the attempt to open up your country to peaceful commerce. With this view *the Queen sends a small steam-vessel to sail along the river Zambesi, which you know and agreed to be the best pathway for conveying merchandise, and for the purpose of exploring which Dr. Livingstone left you the last time. This is, as all men know, "God's pathway" ; and you will, we trust, do all that you can to keep it a free pathway for all nations, and let no one be molested when travelling on the river.*

"'We are a manufacturing people, and make all the articles which you see and hear of as coming from the white men. We purchase cotton and make it into cloth ; and if you will cultivate cotton and other articles, we are willing to buy them. No matter how much you may produce, our people will purchase it all. Let it be known among all your people, and among all the surrounding tribes, that the English are the friends and promoters of all lawful commerce, but that they are the enemies of the slave-trade and slave-hunting.'

"That, on that Expedition, Dr. Livingstone discovered Lakes Nyassa and Shirwa, and the River Shiré Route.

"That on a subsequent expedition he, unaided and alone, continued his explorations further to the north and the west, adding to his discoveries the Lakes Bangweolo and Moero, the head-waters of the Congo, and the true orientation of Lake Tanganyika ; that he was the pioneer of the trade-routes from the coast to the Lakes District, and laid down his life for the cause of the oppressed and of civilisation.

"That, in obedience to his last wishes, the African Lakes Company and various important industrial and missionary agencies were founded by his countrymen to carry out his projects of opening up the Lakes Region to civilisation, of checking the slave-trade at its sources, and of inducing the natives to engage in legitimate commercial pursuits ; exactly in compliance with the views expressed in the despatch of Lord Clarendon already quoted, and afterwards warmly supported by the Earl of Malmesbury and succeeding Ministries, and favoured by the Portuguese Government.

"But the system which was then established, and from which the Scot-

tish people, especially, expected the best results, has recently been compromised by events of the gravest significance.

"The Portuguese Government have raised the tariff on all goods imported through the Zambesi. They seized the *James Stevenson*, a steamer belonging to the African Lakes Company, and they threaten to close the Zambesi to all vessels not owned and manned by Portuguese subjects: thus practically closing to our countrymen the only trade-route to their stations on the Lakes.

"In the meantime, with the wane of British influence, a rapid extension of the slave-trade has taken place in the Lakes Region, and recently a serious armed attack has been made on our countrymen in the Nyassa territory by the slave-traders.

"To a country that prides itself on its hostility to the slave-trade, and that formerly spent £70,000 a year on its suppression on the East Coast of Africa, this is grievously disappointing.

"The Council of the Royal Scottish Geographical Society feel it to be their duty to represent to Her Majesty's Government the universal feeling of the Society and of Scotsmen generally, that to submit to the reactionary policy of the Portuguese Government, in practically closing the district discovered by their fellow-countrymen, would be to proclaim themselves unworthy of the traditions they inherit.

"The Council would strongly urge on Her Majesty's Government the necessity of taking practical steps to protect British interests in that region, to open and to maintain open a 'free pathway for all nations' on the Zambesi and its tributaries, from the coast to the Central Lakes District, by which our countrymen may maintain the position they have founded on the principles of the illustrious Livingstone, and may continue to check the slave-trade of Central Africa, and to introduce to those districts the blessings of civilisation.

"Society's Rooms, 80A Princes Street,
Edinburgh, 23*d April* 1888."

The following is Lord Salisbury's reply:—

"Foreign Office, *April 30th*, 1888.

"Sir,—I am directed by the Marquis of Salisbury to acknowledge the receipt of your letter of the 23d instant, in which you urge on Her Majesty's Government the necessity of taking practical steps to protect British interests in the Zambesi districts, in view of the reactionary policy adopted by the Portuguese Government with regard to the closing of the Zambesi River to all vessels not owned and manned by Portuguese subjects.

"I am to request that you will inform the Council of the Royal Scottish Geographical Society that the question is receiving the earnest attention of Her Majesty's Government, who have already succeeded in obtaining a promise from the Portuguese Government that vessels now navigating the Zambesi shall not be interfered with.—I am, Sir, your most obedient, humble servant, "T. V. Lister.

"The Secretary, Royal Scottish Geographical
Society, Edinburgh."

THE EXTENSION OF ARAB INFLUENCE IN AFRICA.[1]

One of the most striking phenomena in the march of events in Africa is, undoubtedly, the extension of Arab influence from the north-east of the continent over nearly all the northern part, as far as the Gulf of Guinea, and from the east towards the Central Equatorial zone. Like an inundation, it threatens some day to overflow the entire continent. Men of all classes, whether explorers, missionaries, politicians, or philanthropists, alike recognise it—some to extol the effect of this influence on the natives and to depreciate that of European civilisation, others to absolutely deny the value of the civilisation imported by the adherents of Islam and the means by which it is promoted. Without attempting to interfere in the discussion on the question raised in the English, French, and German reviews, we desire, in summing up the data on which all these publications agree, and in adding information furnished by certain special works, to mark the stages of the development of Arab influence in Africa, to trace its actual limits, and to indicate its principal causes.

The development of Arab influence in Africa embraces a period of nearly 1250 years, during which time its progress, though not always uninterrupted, may be divided into three distinct phases, the dates of which, however, can only be approximately given. The first phase does not include more than seventy years of the seventh century of our era. In 640, Amru Ibn al Aassi, the lieutenant of Omar, invaded Egypt with 4000 men, and in 641 he took possession of Alexandria. In order to establish his authority more securely, Omar encouraged the immigration into Egypt of a certain number of Arab tribes, whose yoke was comparatively easy. They imposed only moderate tribute on the natives and exercised no religious constraint whatever. Notwithstanding this, multitudes of natives, repelled by the dogmatic quarrels of the Christians in their midst, and anxious to free themselves from the capitation tax imposed on unbelievers, embraced Islamism.

Amru soon undertook the conquest of the north of Africa; after his death, in 664, the Egyptian Governor, Okba, seized Fezzan, founded Kairwan, and advanced as far as the frontiers of Marocco, which, since 618, had belonged to the Visigoths of Spain. After the battle of Maluya, all Marocco, as far as Ceuta, fell into the hands of the Arabs. The Berbers, who at first opposed, in a short time nearly all adopted, Islamism, and, for the most part, the Arab language as well. Sixty-six years sufficed for the Arabs and Islam to subdue all the north of Africa, from Egypt to the Atlantic.

Under Arab influence, the population of the conquered zone rose to a certain degree of civilisation, from the agricultural, industrial, commercial, and artistic point of view. At that time the Arabs tolerated the existing religions and respected the customs of an anterior civilisation; they attempted even to develop the germs of a culture different from their

[1] Translated from *L'Afrique Explorée et Civilisée*, Février 1888.

own. The large towns like Kairwan, Tlemçen, and Fez were peopled with thousands of industrial inhabitants, and the position of women was superior to what it is at the present day.

Towards the middle of the eleventh century, several nomad tribes, which till then had remained in Upper Egypt, migrated, with their wives, children, and flocks, towards the north-west of Africa. Certain Arab authors computed the number at a million, others at only 250,000. It is probable that they were followed by other nomad tribes who did not settle in the neighbourhood of the coasts, but penetrated into the interior: it is, however, difficult to follow the path of this new influx of emigrants, who interest us more from the ethnological and religious than from the political point of view. All that we can say is, that from the eleventh to the thirteenth century their influence extended to the kingdom of Songhay, north of Timbuktu, and to that of Kanem, to the east of Lake Chad. As early as the eleventh century Sa-ka-si, the fifteenth king of the Sa dynasty, in Songhay, adopted Islamism, and from that time, according to Lenz, the States of the Middle Niger have remained the chief bulwark of Islam, becoming also the centre of an advanced civilisation. It is, perhaps, at this time we can trace the introduction of Islam among the Foulbés.

In this way Arab influence extended along the eastern shores. Undoubtedly, the Arabs had already crossed the Red Sea in 697, and an extensive migration took place in 822; but it was not till the end of the eleventh century and the beginning of the twelfth, that its largest wave was borne towards the eastern side of the Abyssinian mountains. An Arab manuscript, which Dr. Paulitschke has seen, states that in 1195 Omar Walasma, of the Koreïchite tribe, established his authority in a zone of territory between Zeïla and Harrar. His dynasty lasted till the sixteenth century. According to the traditions of the Somalis, the Arabs also established themselves in other places of Eastern Africa, married the women of the country, and successfully repelled the pagan Gallas in the south. Two other important migrations took place in the thirteenth and fifteenth centuries. At the time of their first voyage in Abyssinia, under Christopher da Gama, the Portuguese found the powerful kingdom of the Adals between Tajurrah and Cape Guardafui, whose Mussulman princes were the declared adversaries of Christianity.

In the sixteenth and seventeenth centuries, Arab influence chiefly extended in the Sudan, Nubia, and Kordofan—perhaps even as far as Darfur. With regard to Wadaï, Barth believes that Islam had no footing there till 1640, and Nachtigal says that the tribe which first voluntarily declared itself in favour of Islamism was recognised as the real possessor of the soil; those who were forced to accept it were never placed in the same rank as the others, and finally, those who have only recently emerged from paganism are at the present day considered in the light of slaves rather than free men. The Bagirmi received Islamism from the Sultan Abdallah between 1598 and 1608; the Katsena, in the seventeenth century; and the inhabitants of Kano a little later. However, as Barth says, the great majority of the population of the Hausa country, especially that of the towns, remained faithful to paganism, until the

fanaticism of the Foulbes obliged them to make a public declaration of Islamism. In spite of this, numerous elements of paganism still remain in the State of Kano, as in that of Katsena. Nachtigal has been unable to discover when the people of Tibesti abjured it.

However difficult it may be to trace the line of demarcation between the Mussulman and pagan populations of the seventeenth century, it may be admitted, in a general way, that all the Sudan to the north of the ninth degree had then adopted Islamism.

The third period extends from the seventeenth century to our own day. The principal propagating agents of the Arab influence at the present time are the Foulbes. Hitherto they had been content with founding agricultural colonies in the Central Sudan, but at the beginning of this century they were seized with a proselytising zeal which promised to carry everything before it. A priest of the province of Gobir, Otman dan Fodio, began the religious war against the pagan populations of the Hausa tribes. The conquering Foulbes spread as far as the ocean in the west, and penetrated far into the south and south-west. They attacked Bornu, but without success. Otman then divided the conquered territory into parts:—Gandu, to the west, and Sokoto, to the east, and the sovereigns of these two kingdoms were expected to bring the natives within the pale of Islam. The sovereigns of Sokoto extended their power over Adamawa, and the father of the present sultan, Mallem Adama, founded a new Mohammedan kingdom on the ruins of several pagan States, of which the most important was Kokomi. When the work of destruction was accomplished, the conquerors began to colonise and reconstruct; after having ravaged immense stretches of country they attempted to cultivate it afresh; and in order to establish political unity, destroyed a great number of natives, so that the scattered States, once joined under their sceptre, became available for extensive commercial relations. Thus, the explorer Joseph Thomson writes in the *Contemporary Review* that in comparing the degraded populations of the Coast of Guinea and the banks of the Lower Niger with those of the Central Sudan, what he saw there gave him a very different impression from what he had expected to see. Although he was in the heart of Africa, in the midst of veritable Negroes, they were very different from those he had met in his travels. He found there large and well-built towns, well-clothed people, behaving with self-possessed dignity; and everywhere signs of an industrious community, highly advanced in the path of civilisation, carrying on different trades; the various metals were worked, stuffs were spun and dyed, and the markets were thronged with people. Savage tribes had been transformed into semi-civilised nations; Fetichism, with its degrading superstitions, had disappeared before Islam, which had inspired the Negroes with a new and vigorous life. Thomson adds that Islam reigns at the present day from the Nile to the Atlantic, and from the Sahara as far as the sixth or even the fourth degree north of the Equator.

In the regions of the Upper Niger and Upper Senegal, Arab fanaticism was roused by the marabout El Hadj Omar, who, on his return in 1854 or 1855 from a pilgrimage to Mecca, appeared in the *rôle* of

prophet to the populations of the Western Sudan. He armed his slaves, assembled his people; then, with the Koran in one hand and a sword in the other, he began a war of conquest, accompanied by frightful devastations. At the head of 20,000 fanatical adventurers, greedy of plunder, he first precipitated himself against the Mandingos of Bambuk in order to convert them. He next directed his course towards the Upper Senegal, and against Sego, where the Bambaras were still heathens. Driven back, he turned towards Kaarta, whose inhabitants, the stationary Bambaras, were either killed or accepted Islam. In 1857 he attempted to drive out the French from the fort of Medina, but he was defeated with great loss. His inroad on Timbuktu in 1863 was equally unfortunate. Subsequently, he fortified himself in Sego and in Masina, where he subjugated the Bambaras, obliging them by force to embrace Islam. Since that time Islamism has been carried as far as the Gulf of Guinea, either by means of military expeditions or by the trade caravans of the Hausas. The Mussulmans exist in great numbers in Sierra Leone; in the State of Liberia they exceed the pagans; Lagos counts 10,000. According to Cardinal Lavigerie, there are, at the present day, between the Sudan and the Niger, over sixty million Mohammedans. "Between Sierra Leone and Egypt," says Mr. Blyden, "Islamism is the only intelligent, moral, and commercial power. It has taken possession of the most gifted tribes, and left its impression on their social and religious life. Its adherents rule the politics and commerce of nearly the whole of Africa to the north of the Equator; and, from the important cities founded by them on the Niger and its affluents, they despatch caravans in all directions, to Abyssinia and Egypt, Algeria and Marocco, Liberia, Gambia, and as far as the Cape Coast."

"The active propagation and the triumphs of Islamism," said M. G. Valbert lately, in the *Revue des Deux Mondes*, "have excited the plaints of more than one traveller, and of all those who wish to extend our civilisation over Africa. Consult General Borgnis Desbordes, whose bravery and prudence assured the success of the daring expedition from Senegal to the Niger, and he will tell you that the unconverted tribes only are open to European influence, that they may be moulded by us like clay, whereas the Mussulman States are closed and hostile to us; that in Africa Fetichism is our natural ally, and Mohammedanism our constant enemy. Ask Savorgnan de Brazza, and he will tell you that the only danger he dreads for the future of the French Congo is the Mussulman missionary, whose approach heralds dismay and anxiety."

It is not only on the southern frontiers of the countries under Arab influence that fanaticism is displayed: it has been stimulated in our own day in the heart of the Mussulman territories to the north of Africa, by the activity of the Senussi sect, whose *zaouia* are scattered over all the north of Africa, from the frontiers of Egypt as far as Marocco, and far into the interior.

After several ineffectual attempts to establish himself in Egypt, Mahomed es Senussi, father of the present chief of the sect, the Sheikh-el-Mahdi, founded a central *zaouia* in the oasis of Jerbub, with the intention of reforming Islam and restoring the ancient law of the Koran. The

order which is maintained in these missions has great influence in all the territories in the north of Africa. Owing to its strict discipline, to the large sums of money at its disposal, and the absence of all scruples in the employment of its means, it has become the fiercest and most dangerous foe of Europeans. "It is at Jerbub," says M. Marc Fournel, "that the Sheikh-el-Mahdi receives information from all quarters of the Mussulman world, and directs the great pan-Islam movement. Special couriers, mounted on *meharis* (the wonderful camels of the desert, with which one can achieve 100 kilomètres daily during a week without exhausting them), connect Jerbub with Egypt, Tripoli, and the interior of Africa; in Wadai the Sheikh-el-Mahdi could mobilise in a few weeks an army ten times stronger and more enthusiastic than that which crushed the English and Egyptians in the Sudan, and it is stated that his *zaouia* contains enough modern fire-arms to render his forces sufficiently redoubtable against any European power." Every year the chief of the sect turns out hundreds of missionaries. The first religious establishments formed by them were at Sokna, Murzuk, Ghadames, and Ghat; then they occupied the oasis of Kufarah, colonised that of Wah, and settled at Kawar. From Kufarah they advanced towards Wanyanga and Wadai, whose king became their ally. They even hoped to gain over the territory of the Tubu, Rideyat, the uncivilised tribes of Wadaï, and the oases of Egypt. Their adherents made them splendid gifts, and wherever they founded stations they entered into contracts with the natives to cede date plantations.

In the East, after the Portuguese had occupied the coast, the natives summoned the Sultan of Oman, Ben Sef Ben Malik, to their aid, and he engaged the Europeans in several combats. One of his sons took possession of Mombasa in 1698, and from that time the Portuguese were obliged to retire from one part of the East Coast.

It does not follow, however, that Arab influence reigns undisputed over the whole of Eastern Equatorial Africa. Even to the north of the line which extends from the Gulf of Guinea to the Upper Nile, there exist tribes who have only partially adopted Islamism, such as the Mandingos, and the inhabitants of Futa Jallon; several Wolof and Bambara tribes are still far more pagan than Mohammedan. It is the same in the neighbourhood of Bagirmi, where quite a series of pagan tribes still exist.

In the centre, in the region of the Nile sources and the States on the Lakes—Uganda, Unyoro—up to Tanganyika and even as far as Stanley Falls, and below on the Congo—further south still to the territories to the west of Nyassa and Bangweolo, in the country of the Garanganzé, Arab influence is propagated by traders and slave-dealers. But there yet remain a great number of tribes which the Arabs have never been able to subjugate or impose their creed upon. Thus, the Dinka, Bari, Bongo, Madi, Shuli, and Niam-Niam tribes are still pagan. The Nuba of Kordofan, the Shilluk, the Fundj are only partially converted to Islamism, while the Bagara and Kababish, to the west of the While Nile and north of Kordofan, as well as the inhabitants of Galabat and Takela, are completely Mohammedan.

According to Paulitschke, Islam is making great progress amongst the Gallas. The great tribe of Day has embraced Islamism, while the Walashi and Garura have remained pagan.

However this may be, the Arabs are found everywhere in Eastern Africa, either in colonies of a few families, or as travellers. They are to be met with in all the towns of any importance in Southern Africa as far as the colony of Natal and Cape Town. Nevertheless, they do not sensibly influence the population there.

It is in Egypt that Islam has penetrated most deeply, and is recognised in all the acts of social life. In Algeria the Muftis have little influence, the Marabouts have more, but the Khuan especially direct the Pan-Islam movement. The power of the religious orders rests on a strict organisation, on absolute obedience of every member to the chief, and perfect discretion and servile docility from the mass of the people. Algeria alone has 355 monasteries and 168,954 monks. Among the Tuaregs of the Sahara, there are no mosques, but the Marabouts have the direction of public instruction and the exercise of justice. They go from tribe to tribe like missionaries, teaching the young to read the Koran, and to write, extending the circle of knowledge to those of their pupils who are destined for the ecclesiastical profession, giving them lessons in arithmetic, astronomy, law, and theology. The Foulbés, the most enthusiastic propagators of Islam in the Sudan, have schools in the smallest communities; they specially teach Arabic, though there are also Fula grammars, but written in Arabic characters. In Bornu, at the time of Nachtigal's travels, the secretary of the king, Moallim Mohammed, enjoyed a reputation for profound erudition, his library was unequalled from Timbuktu to Khartum. The lessons of Kuka's masters attracted pupils from all parts of the Sudan. At Logone, as at Bagirmi, the knowledge of Islam consisted merely of a few incomprehensible phrases recited mechanically. It is very different in Wadaï, where the *ulemas* possess, in addition to the Koran, several treatises read by everybody. As a contrast, in Kordofan, according to Wilson and Felkin, the people have scarcely any religious ideas, but any amount of superstitions. Between the upper course of the Rahad and that of the Atbara, the Negro republic of Galabat has 20,000 pilgrims from Darfour and Wadaï, who, on their return from Mecca, have settled there, and are recruited every year by fresh arrivals. These are the Mussulman fanatics, who conscientiously practise their religious observances. The Mombuttus have only externally submitted to Arab influence. Among the Gallas, some are attached to Islam to the point of fanaticism, while the rest are pagans. Krapf says that Islamism has already corrupted the weak, debased nature of the Gallas, and that the Wollo, in particular, are unsurpassed in treachery and love of vengeance. The Somalis readily receive the teaching of Islam, according to the interest of the moment; they are not fanatics, any more than the Swahelis, the advanced sentinels of Islam in Eastern Africa, who, however, are sincere Mussulmans.

As to the Waganda, Wilson and Felkin were still able to say a few years ago that foreign religions had had up to that time but little influence on them. Though Arab traders had been in the country

for sixty years at least, they had not done much proselytizing. The conversion of Mtésa was only apparent—the Arabs themselves did not believe in it. He would never submit to the rite of circumcision, which Islamism imposes as indispensable, and he even caused about a hundred young men to be burnt alive who, believing that Islam would become the universal religion, submitted to this rite. But if Islam is but slightly extended in Uganda, the Arabs nevertheless exercise a considerable influence on King Mwanga and his ministers. They are able skilfully to keep alive in the minds of these great personages all sorts of prejudices against Christian missionaries and Europeans in general, in whom they recognise competitors for their commerce, and above all enemies to slavery and polygamy, usages tolerated by Islam.

Our article is long enough already, but we cannot conclude without adding a few words on two or three facts which it is impossible not to take into account, while seeking to comprehend what it is that makes the power of Islam, and procures it so relatively easy an access among Negro populations. The prescription of the Koran, commanding every Mussulman to make, once in his lifetime, the pilgrimage to Mecca, gives thousands of pilgrims the opportunity of receiving orders from the actual chief of the believers, and becoming inspired with the same proselytizing zeal as that which animated the ancient Israelites at Jerusalem. Those who have performed the journey bear the title of *Hadji* (pilgrim), and are held in greater honour the further their country happens to be from Mecca. Between all the Hadji there exists a confraternity which establishes bonds of union and religious cohesion which nothing can sever. The Mussulman missionaries are no respecters of persons; they are truly cosmopolitan; every man who believes in Mohammed is their equal though he has woolly hair, a flat nose, and hanging lips. Whether they arrive from Kairwan, Cairo, or Marocco, their worldly goods are limited to their books and the mat on which they kneel to pray; their pupils accompany them, and in settling in some Fetich village they form the nucleus of a school or congregation. The Arab missionary lives like those by whom he is surrounded; he accommodates himself to the habits, customs, and tastes of the natives, and subsists on the charity of those he instructs. At home everywhere, he feels no repulsion in marrying some daughter of the Dark Continent, and by this intermixture of blood the races are crossed. Arabic is the literary language of Central Africa. Though there may be Arabs who are guilty of an infraction of the law of the Koran prohibiting the use of spirits, and who enrich themselves by the traffic in brandy, it must be admitted that as a rule the adherents of Islam set the Negroes an example of extreme sobriety which inspires the latter with respect and instinctive confidence for men who are always masters of themselves.

Enough has been said on the causes of the extension of Arab influence in Africa. It is for those who would help to endow the Dark Continent with a superior civilisation to take these facts into serious consideration.

RECENT EXPLORATION IN TIERRA DEL FUEGO.

By John Gunn,

"Challenger" Expedition Commission.

Introductory.—The explorations carried on in Tierra del Fuego by Mr. Popper, C.E., accompanied by Don Julio Carlsson, some skilled assistants, and a body of labourers—making in all a party of eighteen men—and by Mr. Cosmos Sprio and a friend, have done much to widen our knowledge regarding the physical features and natural resources of what is yet, to a great extent, an unknown country. In common with most remote and but partially explored corners of the earth, Tierra del Fuego was credited by the geographers of the sixteenth century with being one of the numerous places inhabited by tailed men; and fables, although scarcely so absurd as that just quoted, continue to be associated with popular notions concerning the island and its inhabitants, despite the visits and partial descriptions of such navigators and naturalists as Cook, Weddell, Fitzroy, Darwin, etc. The confusion of ideas still existing in this connection is well illustrated by Mr. Popper's experiences when endeavouring to ascertain, from sealers and sailors who had visited the island, such information as would be likely to prove of use during his journey. The divergence in the statements of those consulted was truly remarkable; no two agreed as to what was to be seen or might probably be experienced. Some declared that the whole face of the country was covered with impenetrable forests, amid the recesses of which a race of puny, decrepit Indians eked out a miserable and useless life. Others were positive in saying that the whole land was bare of timber, the soil cold and sterile, the scenery monotonous and depressing, and the inhabitants a tribe of giants. Nor were there wanting those who spoke enthusiastically of "the picturesque beauty of the valleys and mountains." No conclusions whatever could be drawn from these and similar statements, but we now know that there was truth in all of them, and that Tierra del Fuego is so diversified in its surface, and so varied in its soil and climate, that a person visiting a single point on its shores is almost sure to have experiences widely differing from those of another who may land at no great distance from the first, and if they push any way into the interior their impressions are still more certain to differ. Such would appear to have been the case with Mr. Popper's informants; they had visited different parts of the country, and spoke of the whole from their experience of comparatively small areas.

Physical Features.—At the extreme south-west of the island a range of mountains attains, at its highest point, an altitude of 7000 feet; from it two chains run out in, respectively, south and west directions, and at nearly right angles to the principal range. From the neighbourhood of Useless Bay smaller elevations run in parallel courses towards the north-east. The first of these has been named Carmen Sylva in honour of the Queen of Rumania; it crosses the middle of the island, and termi-

nates in the cliffs of Cape Sebastian facing the Atlantic Ocean. The second range rises rapidly in the vicinity of Cape Boqueron, stretches out towards the Straits of Magellan, and gradually merges into the high table-lands between Cape Espiritu Santo and San Sebastian Bay. This range is known as the Sierra Balmaceda, and was crossed by Mr. Popper's party, after experiencing the greatest difficulty in crowning the ridge, on account of the deep snow with which it was covered, the shovels of the explorers being in constant requisition in order to clear a path. This obstacle and others, encountered when descending the southern slope, in the shape of thick timber and almost impenetrable undergrowth, caused five days to be consumed in struggling over six miles. Mr. Sprio, also, bears testimony to the slow progress travellers in Tierra del Fuego must frequently be satisfied with, for it has taken him a month to cover 40 miles, whereas, under favourable circumstances, he was often able to advance at a rate of 20 miles per day.

The rivers examined in these recent surveys are the Juarez Celman, the Carmen Sylva, the Gama, the San Martin, and the Cullen, with two rivulets, named by Mr. Popper the Alpha and Beta. Of these the Juarez Celman is the largest and most important. Rising among the highest hills of the island, its course lies, for the most part, through the great central plain. From the observations made, which, from want of time, can only be considered as approximate, the velocity of its current is 1 mètre 10 centimètres per second, with a width, at 28 kilomètres from the mouth, of 70 mètres at low water, rising at high water to 800 mètres. The water is bright and clear, and had a surface temperature of 8° Cent. in November. It is believed to be navigable for a considerable distance, and, if this be so, the stream should form a commercial highway of great importance when the country is opened up and ready to take advantage of its resources. The direction of its course is towards the south. The Santa Maria flows south-west, its waters are yellow and muddy, and, where crossed by Mr. Popper's party, ran through a deep gorge or cañon, with precipitous sides, the descent of which was not accomplished without difficulty and danger. The Carmen Sylva flows south, the San Martin west, and the Cullen, Alpha, and Beta towards the north.

Between Porvenir Bay and the river Santa Maria the country is undulating, the slopes clothed with thick brushwood, and the hollows damp and marshy. The whole land between Useless and San Sebastian Bays is a dreary monotonous plain, its grey earth not much hid by a scanty growth of yellow, sickly grass; not a tree or bush relieved its expanse, except near the sea or in the vicinity of rivers, where glades, or *canadas*, lent a most refreshing variety to the view. In these spots the verdure was green and fresh, with trees and underwood growing in some profusion. To the north, and also, perhaps, to the south—although the information regarding the country in this direction is rather vague and unsatisfactory—the plain appears to be much more fertile, and promises well for stock-raising. Mr. Sprio met with numerous swamps or "lagoons" in these pampas, which, from their extent and nearness to each other, made the passage through them a work of great difficulty.

Geology.—There is no want of evidence throughout the island to show that the land is rapidly rising. Lines of cliffs bearing unmistakable traces of wave action at no very remote period occur at several places more or less removed from the present high-water mark—notably near Cape Sunday, where they run far inland, on the borders of the Cullen valley five miles from the sea, and, again, to the south of San Sebastian Bay. Trigonometrical surveys made between Capes Sunday and Peñas proved beyond doubt that since the visit of Captain Fitzroy the coast-line has advanced three kilomètres. On the western shores of San Sebastian Bay the lately dried land has not yet had time to assume a covering of vegetation, and the detritus from the older part of the island, laid down in the sea, now lies exposed, cracked, and desiccated by atmospheric action, but otherwise in much the same condition as when covered by the waters of the ocean. Erratic boulders are exceedingly common all over the country; they are usually of granite, syenite, and gneiss, sometimes traversed by quartz veins, and without a trace of similar rocks *in situ* near them. Although generally confined to the plains, these blocks were frequently found at altitudes of 300 mètres, although at such heights they were considerably decomposed and weathered. That they were carried over the water by icebergs, and let fall in their present position seems clear. *Patellæ* and *Mytili* shells are constantly found associated with them. The higher grounds having been longer exposed than the plains to the action of the elements explains the partially disintegrated condition of the boulders seen on the more elevated portions of the country. They have all a more or less vertical position, which may have been caused by their having had to pass through some depth of water after being dropped by the transporting icebergs and before reaching the bottom. From the configuration of the banks of the rivers which have been surveyed—all having cliffs to the south and gently sloping plains to the north—it would appear that the tendency of elevation is to the south-east.

In a line of cliffs near Cape Espiritu Santo an interesting discovery, in the shape of a bed of lignite, was made by Mr. Popper's party. The dip of this bed closely follows that of the land, rising from a height of 6 feet at its extreme inland point to 120 feet near the sea. In it trunks and branches of carbonised trees are presented, imbedded in a schistose formation; these fossil trees differ entirely from any now seen on the island, their presence indicating a great change in the climate and physical conditions of the region. From measurements made by Don Carlsson the following tabular description of the cliff has been compiled:—

Vegetable Earth, . . .	0·60 mètres.
Gravel, ...	1·00 „
Sandy Conglomerate, . .	9·00 „
Sandstone, . . .	3·00 „
Gravel, ...	6·00 „
Carboniferous Bed, . .	0·70 „
Sandstone, . . .	4·00 „
Conglomerates, . . .	22·00 „
	46·30 mètres.

A number of petrified trees are presented in a cliff 80 feet high on the north shore of Useless Bay. The trunks lie in a horizontal position: they vary from 30 to 40 centimètres in diameter, and have clearly marked concentric circles. Many of them have been turned into a crystallised calcareous spar. Fossil shells, imbedded in an argillaceous rock, are also found in the neighbourhood, which promises an interesting field for exploration by geologists who may in future visit the island.

The curious effects of weathering upon the rocks is especially remarkable in the vicinity of the Beta. Here one solitary pillar has been so carved by atmospheric action as to assume the likeness of a huge human form; it is at first difficult to believe that it is not artificial.

So far as yet discovered, the whole of the rocks of the island appear to belong to the Tertiary Period; they are "large stratified masses associated with sandstone, sometimes laminated, and covered with a layer of from 5 to 20 feet of coarse gravel or pebbles of a rather angular shape." The other rocks, chiefly erratic blocks we suppose, are granitic and felsitic porphyry, diorite, gneiss, granite, serpentine, syenite, trachite, quartz, amphibolite, and petro-silex. Extensive beds of dark blue sand, principally composed of magnetite and small rubies and garnets, are frequently met with.

Gold is as yet the only metal discovered in Tierra del Fuego. Mr. Sprio has found traces of it in all the streams he has examined, and the evidence collected by Mr. Popper points to its very general distribution. It is alluvial, and shows signs of recent formation in the sea bottom. It consists of 90 per cent. of pure gold, 9·5 per cent. of silver, and 0·5 per cent. of other substances. Gold-seeking appears to be the popular occupation on the rivers of the west coast, the people giving themselves almost entirely up to it, to the neglect of other more useful and, could they be brought to see it, more profitable employment. A party working or a Greek speculator in the cañon of the Rio Santa Maria informed Mr. Popper that uninterrupted work brought them 30 to 40 grammes per day, which they appeared to consider a fair return for the speculator's capital and their own labour.

Flora.—The flora of Tierra de Fuego is more varied and luxuriant than might be expected from popular accounts of the island; indeed, the more common plants show little difference in variety and strength of growth from those on the other side of the straits. The northern parts, as might be expected from the more genial climate which prevails there, is the garden of the country, but even to the south there are extensive and spreading plains, covered with a variety of fine grasses, and forming a splendid pasture country fitted to support large herds of cattle. The department of San Sebastian would be especially suited for stock-raising had it a better supply of timber, and this deficiency is all the more to be regretted when it is known that other parts of the island less suited for the operations of the rancher have an abundant covering of wood. In the departments of Buen Suceso and San Sebastian alone there are over two hundred square leagues of good pasture land. Settlers are already beginning to spread themselves towards the south, and

manage to raise remunerative vegetable crops. Pansies, carnations, forget-me-nots, violets, and many other sweet old-fashioned flowers make gay the gardens of the settlers, and are raised without any difficulty. It is to be regretted that so many of the people should spend their time in an almost fruitless search for gold, when so much land awaits those ready to seize the advantages it possesses.

The part of the island lying between Useless Bay, the Atlantic Ocean, and a line drawn through Cape Peñas, supports extensive forests of beech and *Drymis winteri*, among which a fine cypress, *Libocedras tetragonus*, is not uncommon. To the west of Useless Bay, however, the area under timber is not large. The foot and lower slopes of most of the hills are covered with a more or less dense growth of bushes, principally *Berberidæ*, an *Escallonia*, *Ribes magellanica*, an *Embothrium*, *Myrtus mummularia*, and *Berberis ilicifolia*, the latter being much the most common; indeed, along a large part of the Atlantic shores of the island it is the only bush seen except a few "black bushes," or *Salicemiæ*. Lichens abound on the heights towards the west, as well as on several small arid areas where nothing else appears to be able to thrive. More than half the high ground traversed by Mr. Popper's party was covered with a mixture of grasses, principally *Poa* and *Festuca;* the valleys are full of tussock and *Arrhenaterum avenaceum*. The tussock makes a fair substitute for asparagus, and *Teesdalia* for radish. Wild celery is common.

The undulating ground in the vicinity of the Santa Maria River is covered with *Empetrum rhubrum*, but the bushes are small and stunted; they also occur on the southern slopes of the Sierra Balmaceda, along with some *Myrtus mummularia* and a few *Berberidæ*. Lower down, on the same slope, Mr. Popper passed through what he well names an Antarctic forest. It consisted principally of beech and magnolia growing so close as to make progress through them a work of difficulty. Thousands of uprooted trunks lay in all directions, humid and decomposing. Many of the trees still standing were found to be dried up, rotten, and so light that trunks, even of a couple of feet in diameter, could be easily plucked up by the passing traveller in one hand.

The bark of the magnolia smells and tastes like that of the cinnamon, and may, in the future, prove a valuable commercial commodity.

Fauna.—For an island situated so close to continental land as is Tierra del Fuego, the fauna must be pronounced poor. There are but five species of quadrupeds, viz., the guanaco (*Auchenia*), the dog (*Canis fuegianus*), the tuco-tuco (*Ctenomys*), a fox, and a small rat. The guanacos are few in number, and are seen in smaller flocks, and are much wilder than in Patagonia. The tuco-tuco, on the contrary, swarms in every direction, and its extraordinary burrowing powers have been used to such an extent on the barren portion of the central plain as to cause the journey across, especially if undertaken on horseback or with baggage animals, to be performed with difficulty, often with danger both to man and beast. Foxes frequent the glades, or where abundant cover may be found. Birds are numerous, most of them being fit for food. The most common species are the *Centrites niger*,

Vanellus cayanus, the *Surnia funerea*, and the *Chloephaga magellanica*. Ducks, geese, curlews, green plovers, buzzards, and swans are all abundant, and make welcome additions to the supplies of the explorers. Owls, bandurrias, falcons, gulls, etc., were also seen. The teru-tero, as the *Vanellus cayanus* is called here, is a most undesirable travelling companion on the plains; the bird follows any moving figures he may see, and by his well-known cry prepares the Indians to receive visitors, which, when strong enough, they do in a far from friendly manner. Their noise, also, scares game, and makes hunting much more difficult than it would otherwise be. Seals and sea-lions appear to be getting scarce, and few are to be seen along the shores.

The Fuegian dog is a great coward, and of little or no use as a hunter. It is, therefore, somewhat difficult to account for the large numbers kept by the Indians at their encampments, but Mr. Popper, judging from an incident which came under his immediate observation, suggests a solution, which is certainly ingenious. His theory is that these animals are taught to cluster and pack themselves tightly round their master and his family when asleep, and thus produce a very necessary degree of heat, where scanty garments of skin and a few branches, by way of a hut, form the only protection against the extreme cold.

Meteorology.—The climate of Tierra del Fuego is one of the stormiest on the whole globe, accounted for partly by the continuous current of cold air which, drawn down from the elevated glaciers and snow-covered mountains of the south-west, whirls eastwards over the pampas until it reaches the coast, where, under the influence of the sun, an ascending column of heated air is generated, and marks the centre of minimum barometric pressure. Another cause of the climatic conditions of the island may be found in the ocean currents flowing from the coast of Brazil and from the Antarctic regions; these meet off the coast, and are supposed to exercise some influence on the west winds which lash that shore. These winds begin, as a rule, to blow at daybreak, increasing in force by noon, and in the evening frequently attain a velocity of forty mètres per second. At dusk it becomes calm, and there is no wind for several hours. Winter, when there is only six hours between daybreak and sunset, is the calm season. Then the winds, when they do blow, are generally from the north, and, along with the effects of the Brazilian current, tend to modify the temperature, so that the minimum is seldom under 10° below zero. Mr. Popper carefully noted the results of his observations with both thermometer and barometer, and found that the maximum height of the former was +23°, and the minimum −6°. The average temperature of the air between the hours of 6 A.M. and 6 P.M. was +11·5°, and during the night +2°. The mercury in the thermometer generally stood highest at 10.30 A.M., and fell lowest at 10 P.M. Nothing definite could be deduced from the signs of the barometer; a longer experience of its working in this climate must be obtained before any rules can be laid down for the guidance of observers.

Positions.—Mr. Popper was able to accurately fix the positions of

several points on his line of march, and this must be considered not the least useful of his observations. He satisfied himself that the north shore of Useless Bay really lies three miles further north than is indicated on our charts. The following are the positions of the points fixed by the explorer:—

	Lat.	Long.
North Shore of Useless Bay, .	53° 25′ N.	70° 9′ W.
San Sebastian Bay, . .	53° 15′ N.	68° 13′ W.
Mouth of the Juarez Celman, .	53° 46′ N.	
Mouth of the Carmen Sylva, .	53° 40′ N.	
Mouth of the San Martin, .	53° 16′ N.	
Mouth of the Cullen, . .	52° 53′ N.	
Mouth of the Alpha, . .	52° 44′ N.	
Mouth of the Beta, . .	52° 45′ N.	
The Three Sphynxes, . .	53° 15′ N.	

The Indians.—The aboriginal Indians are stout, tall, and strong, some of the men being over six feet in height, and the upper part of the body well-made and developed. Their skin is of a light copper colour, smooth and oily to the touch. A tonsure, produced by the clever manipulation of a hot cinder and rudely made comb, appears on the middle of the head, around which their long black hair falls in dull, heavy locks. The face is generally oval, of orthogonal type, with a narrow brow, prominent and nearly horizontal eyebrows, high cheek-bones, and an almost aquiline nose. The mouth is generally medium-sized, and contains teeth of a yellow colour. The ears are large, pendulous, and altogether badly shaped. The men display a very few hairs, often not more than three, on their chins. The whole character of the head resembles that of the North-American Indian. Their legs are thin, showing little or no calf, and in striking contrast to the strong shoulders, arms, and breast above them. The clothing of both sexes is the same, and consists of a cloak of guanaco skin slung over the shoulders; it is thus difficult to distinguish the men from the women at a little distance, indeed it would be impossible to do so were it not for the burden with which the latter is always loaded on the march, her lord and master contenting himself with carrying his weapons. The men wear a triangular piece of skin on the forehead, seemingly by way of ornament, and some of the married women deck themselves with a few shells of kinds common on the shores. A pouch, or small bag of skin, is carried by the men, containing their food, a bit of dried fungus, a piece of iron pyrites or stone, and a small purse full of a red pigment, probably that used in decorating their faces, for they paint with a lavish if somewhat unskilful hand. Their weapons consist of bows and arrows, spears, and harpoons. Bow-strings are manufactured from the sinews of the guanaco, and the arrows pointed with sharp flints or such bits of broken glass as they can pick up on the shores.

Their dwellings, or rather shelters, are composed of a few branches of trees stuck into the ground, beneath which they crouch without any

attempt to form a roof to protect themselves from the severe rains. Near the sea a tribe was found living in holes which they had dug in the ground, where they appeared to enjoy, for them, a considerable degree of comfort.

These Indians are extremely quick and nimble in their movements, and can cover a surprising amount of ground in a short time. The spaces between the tracks left in the sand by a flying native were measured by Mr. Popper, and found to average 1 mètre 90 centimètres.

They inflict wounds upon themselves—whether from a religious or other motive does not appear—and display little concern when undergoing the operation, although the gashes inflicted are often of rather a serious nature. They can remain without food for a considerable length of time without appearing to suffer any inconvenience. Mr. Popper heard of an instance in point where a girl fasted for nine days, and when, at the end of that time, a sheep was set before her, showed little inclination to eat. At last she fell-to, and when the meal was ended nothing remained of the carcase but the bones, nor did she appear to be at all uncomfortable afterwards. The horses of travellers are never safe from the natives, as they consider horse-flesh one of the greatest delicacies, and prefer it to mutton. On one occasion Mr. Popper's party was so reduced for want of food that they had to kill one of their horses and eat part of it, which they found made a very good dish for hungry men.

The Indians appear to be, upon the whole, a cowardly race, although, when they imagine they are in sufficient numbers, they do not hesitate to attack travellers; but it must be admitted that they are not at all treacherous in any hostile movements they may undertake. Mr. Popper had more than one engagement with parties of hostile Indians, and on the last occasion was compelled to shoot down some of them, an action on his part which appears to have had a most excellent moral effect, as when Mr. Sprio passed over that part of the country some time afterwards, he suffered much less annoyance and interruption from the natives than at any former period. They appear to have a superstitious dread of the mountains, and never venture among them. Travellers, when traversing the higher grounds, have never been annoyed by the natives, who show the greatest disinclination to approach the heights.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

RECENT events in East Central Africa having combined in bringing about a state of affairs which seriously threatens the present position and future prosperity of the Scottish missions and trading companies in the Lakes Region and Shiré Highlands, the Council of the Society has taken up the matter on national grounds, in order to support the work of Dr. Livingstone, who was the first to discover and to open up to European settlement and missionary enterprise the Lakes Region of Central Africa. The whole subject has twice been brought before the Society by the Secretary, Mr. A. Silva White; on the first occasion, at a meeting of the Geographical Club in Edinburgh, on 21st April, and on the second occasion, at

a meeting of the Society, in Edinburgh, on 14th May. The paper which Mr. Silva White read on this second occasion, together with a report of the discussion that ensued, is published in this month's *Magazine*. The Council's memorandum to the Marquis of Salisbury, and his Lordship's reply, are given in the Appendix. Mr. Silva White and Mr. Will. C. Smith acted as the representatives of the Council on the occasion of the recent London Conference on African Affairs, and on the subsequent deputation to Lord Salisbury.

At the meeting of the Society on the 14th May, which was presided over by Dr. George Smith, C.I.E., it was resolved to request the Council to continue to use its influence in favour of the Scottish agencies on the Lakes, who have done such excellent work in developing the country and in benefiting the natives.

The Council has granted the Diploma of Fellowship to the following gentlemen :—Rev. Robert Hamilton (Melbourne) ; Charles N. Bell, Esq. (Winnipeg) ; John Tod, Esq. ; Erskine Beveridge, Esq.

GEOGRAPHICAL NOTES.

EUROPE.

Population of Budapest.—The Magistrates of Budapest ordered an assessment of the population of the Hungarian capital on 1st July 1886, as the next census is not to be taken until 1st January 1891. Mr. Joseph Körösi, director of the local statistical bureau, has published the results. On 1st July 1886 the whole civil population numbered 411,917 souls, showing an increase, in the past five and a half years, of 51,366 souls. The number of resident military was 10,640 souls. At the time of the assessment, 16,308 persons were absent from Budapest. The actual population is therefore estimated at, at least, 440,000 souls. The increase thus shown has been $2\frac{3}{5}$ per cent. per annum. The population in the suburbs has more than doubled.—*Deutsche Rundschau*, May 1888.

German Emigration.—The official statistics give the following estimate of German emigration :—

1880 . . .	117,097	1884 . . .	149,065
1881 . . .	220,902	1885 . . .	110,028
1882 . . .	203,385	1886 . . .	83,177
1883 . . .	173,616	1887 . . .	97,712

—*Le Mouvement Géographique*, 6 May 1888.

ASIA.

An Early Map of Northern Asia.—Baron A. E. Nordenskiöld, Honorary Member of our Society, has kindly sent us a reprint of a short article, entitled *Den Första på Verkliga Iakttagelser grundade Karta öfver Norra Asien* ("The First Map of Northern Asia based upon Authentic Observations"), which appeared originally in the Swedish magazine, *Ymer*, for 1887. After briefly alluding to the meagre accounts of the northern lands of Europe and Asia possessed by the ancients, Baron Nordenskiöld makes mention of several cartographical works of a general character which were published in the fifteenth and sixteenth centuries, until with the year 1668 he comes to the map which he specially has in view, and two reproductions of which accompany the article. The map in question was drawn up at Tobolsk, in Siberia, in the year named, at the instance of Gudenoff (Godunoff), voivode of Siberia. It is not only the first map of Siberia constructed in that country itself, but also one of the first

specimens of Russian cartography known to us, and, what is of still greater importance, the first map of those northern regions which is based upon real observation. Neither the original map, nor yet any copy of it, is known to exist either in Siberia or in Russia. Fortunately two copies, differing somewhat in detail and method, have come to light in the archives of Sweden, having been carried to that country by two members of an embassy sent by King Charles XI. to the Russian court in the year 1668. The map embraces the region lying between Astrakhan, Archangel, Yakutsk, and China. It shows very plainly what were the nature and extent of the geographical knowledge possessed by the Russians about Siberia and the region indicated at the end of the seventeenth century. Curiously enough, the draughtsman traced his map looking at it from the north, not, as we generally do now, from the south. China is shown in the south-east corner as a small triangular patch shut off from the rest of Asia by a small embattled wall.

Report on the Meteorology of India in 1886.—The admirable system of meteorological observations established and developed under the Government of India by Mr. Blanford, is being carried on by Mr. John Eliot, whose first Annual Report, for the year 1886, has reached us. This volume, which retains the form adopted by Mr. Blanford, is the twelfth issued by the Department. It contains records of eight meteorological elements from 139 stations, including two new stations of great importance—Mandalay, and one of the Cocos Islands in the Bay of Bengal. The data are arranged in the following order:—solar radiation and duration of sunshine, nocturnal radiation and temperature of the ground, temperature of the air, atmospheric pressure, winds, hygrometry, cloud-proportion, rainfall.

As formerly, the monthly means for the year are given in an appendix. The first part of the book consists of tables showing the average values of the different elements, calculated from all available trustworthy observations, each being followed by a table showing the differences between these averages and the values for 1886. The main features of the variations during each month and throughout the year are pointed out in each case, and a general review for the year is given in a final summary.

The chief points of interest in the meteorology of India during 1886 may be noted briefly. A well-marked wave of cold passed from west to east during the first week of February, reducing the average temperature for that month below the normal. The conditions of pressure, humidity, and rainfall in Upper India associated with this cold wave raise some questions of very considerable importance, especially when taken in connection with the unusually well-marked character of the north-east monsoon circulation and the excess of the "cold-weather" rains. It is to be noted that these conditions during the first three months of 1886 fulfilled a prediction based on the fact that the south-west monsoon rains were deficient in Sind, Guzerat, and some parts of Bombay in 1885, and that the monsoon current retreated somewhat earlier than usual.

In 1886, the south-west monsoon rains were established over the whole of India before the end of the third week in June. The distribution of the rainfall during the season was determined chiefly by the relative strength of the Bombay and Bengal monsoon currents. The Bengal current was somewhat stronger than usual during June and July, and continued to blow with great steadiness, although with diminished force, till the end of the season. The Bombay current, on the other hand, after blowing vigorously during the whole of July, decreased in the beginning of August, and by the first week of Septem-

ber was almost confined to the coast districts. The rainfall during June and July was excessive in almost all parts of India except the Central Provinces. In the latter part of the season it was above the average in Bengal, Behar, Chutia Nagpur, and the eastern half of the North-West Provinces, while there was a serious deficiency in the Punjab, the western districts of Rajputana, Central India, and the Central Provinces. The anomalous distribution of rainfall above indicated is remarkable in many respects, and seems likely to give much valuable information regarding the causes which regulate the "burst of the monsoon" and the subsequent rains.

Mr. Eliot is of opinion that the cause of the weakness of the Bombay current is to be sought in the sea area to the south, and not over India itself, although an abnormal distribution of pressure is recorded during the whole of the south-west monsoon period, the most noticeable characteristic being high pressure to the south of the Gangetic valley, where the barometer is usually low during the rains.

A great deal of valuable data is given regarding cyclones originating in the Bay of Bengal, and an excellent chart shows the tracks of these storms.

In his final summary, Mr. Eliot gives a sketch of the general features of the meteorology of India, and a short discussion relative to the supposed area of ascending currents in Central Asia during the south-west monsoon, the upper return current, and the question as to whether this monsoon is or is not a continuation of the south-east Trades. Criticism of Mr. Eliot's remarks is impossible here, but in view of Buchan's recent researches in connection with observations on Ben Nevis and elsewhere, we would urge the necessity of a complete revision of the factors used in reducing temperatures and pressures to sea-level, and of the exercise of greater caution in selecting *pairs* of stations at high and low levels for inquiries concerning general vertical movements of the atmosphere.

The tables are clear and accurately printed throughout, hardly any errors being observable. The labour involved in calculating and reducing must have been enormous, and it seems doubtful whether some of the observations are worth it—especially those of the radiation thermometers. The continued application of Lambert's somewhat meaningless formula seems also unnecessary. But whatever the value of these reductions, the primary function of such a report is discharged to admiration—the averages of actual observations are made easily accessible, the positions of the stations where the observations were taken, and the circumstances under which they were obtained are clearly stated.

Irrawadi Expedition.—In our March number (page 159) we briefly referred to the expedition up the Irrawadi, conducted by Captain Rimmer on behalf of the Irrawadi Flotilla Company. By the courtesy of the Company, who have placed Captain Rimmer's reports at our disposal, we are now able to add the following details.

Captain Rimmer made a rough survey of the Irrawadi from Hokat to the confluence of the Myingai River, a point which was reached on the 19th day from Bhamo. He reports the river navigable for a distance of 140 miles, or within 10 miles of the Myingai mouth, when a cataract intervenes, over which, for the present at least, steamers could not pass. Beyond Mineah, the country is entirely inhabited by wild Kachins and border Chinese. The country above Hokat is more populous, and apparently more fertile than below that place, though the inhabitants, owing to the difficulties of communication, are more

primitive in their habits. The Kachins cultivate cotton and poppies; they bring honey, beeswax, and caoutchouc into the Shan villages for barter.

At a large village 10 miles above Hokat one of the roads into China terminates, but since the annexation all trade has been stopped, owing to the lawlessness of the hill-tribes on the British side of the frontier, who levy such heavy blackmail on all caravans passing through their country as to paralyse all traffic. From the same cause the road from Waiman into China has been disused since the annexation by the Chinese traders. Captain Rimmer says the Irrawadi, near the furthest point reached by him, is over 750 yards broad, and the channels, which are well defined, are not subject to alteration; no fogs are experienced beyond Hokat, and the temperature is higher and more bracing.

AFRICA.

Exploration of the Mobangi-Welle.—We have already announced (vol. iv. page 211), the undoubted solution of the long-vexed Welle problem through the recent important explorations of Captain van Gèle and Lieutenant Liénart. The latter, on his return to Belgium, after an absence of three years, has supplied M. Wauters (the successful originator of the Mobangi-Welle hypothesis) with a verbal account of the expedition, which is reproduced in the *Mouvement Géographique* for 22d April 1888, accompanied by some instructive illustrative maps. As we know, it was in 1870 that Dr. Schweinfurth discovered the Welle. Based upon native information, he identified it with the Shari, which flows into Lake Chad. Seven years later, Stanley, descending the Congo, passed the mouth of the Aruwimi, which he thought must be no other than the mouth of Schweinfurth's Welle. For six or seven years it was a matter of discussion between geographers and explorers as to whether the Aruwimi or the Shari were the lower course of the Welle. On his second journey on the Upper Congo, in 1883, Stanley, having ascended the Aruwimi to the Yambuya Rapids, was strengthened in his supposition. The Mobangi was discovered in 1884 by Captain Hanssens and Lieutenant van Gèle, and in November of the same year the river was ascended for the first time by the Rev. George Grenfell as far as 1° 25′ north latitude; later, Mr. Grenfell reached 4° 20′ north latitude. On Mr. Grenfell's return to Brussels, M. Wauters originated his hypothesis (*Mouvement Géographique*, 31st May 1885). This hypothesis was hotly contested, even after the return of Dr. Junker, who, having explored the Welle, coming from the east, as far as the 23d degree of E. longitude, gave his support to M. Wauters's theory. The Government of the Congo Independent State then placed the steamer *En Avant* at the disposal of Van Gèle and Liénart, and instructed them to solve, if possible, the problem of the Welle. The first ascent of the Mobangi was made by them in October 1886, but they got no further than the Zongo Rapids (4° 20′ north latitude). Another attempt to reach Junker's Furthest, across country by the Itimbiri, likewise failed. The third and last effort succeeded, however; as we have already stated, the explorers ascended the Mobangi, passed the rapids, and reached the twenty-second degree of east longitude (or within one degree of Junker's Furthest, on the same latitude), where an accident to the *En Avant* and the hostile attitude of the natives forced them to turn back. But the geographical problem has been solved to the satisfaction of all.

The same *Mouvement Géographique* gives some interesting particulars of the expedition under Van Gèle. Organised at Equator Station, its transport consisted of the steamer *En Avant*, towing a large canoe from Stanley Falls capable of holding one hundred persons. The *personnel* of the expedition

were, besides Captain Van Gèle and Lieutenant Liénart, the captain of the steamer, the engineer, Schönberg Hanssens, seventeen Hausa soldiers and Zanzibaris, and twenty-four natives from Equator. The expedition left on 26th October 1887, and safely reached the Zongo Rapids on 21st November, when their difficulties commenced. It was not before the 11th December that the *En Avant* passed the sixth (Mokuangaï) rapid, and entered the free and magnificent river beyond. The rapids commencing at Zongo are thus named—(1) Zongo ; (2) Bonga ; (3) Belly ; (4) En Avant ; (5) Elephant ; (6) Mokuangaï. They cover a distance of 24 miles. From the third to the last rapid, navigation, even outside the rapids, is extremely difficult—rocky islets and reefs offer frequent obstructions ; in certain places they present a veritable labyrinth, which can only be passed with the greatest circumspection ; and it took the expedition three weeks to get through. Captain Van Gèle describes the country as very beautiful. Both banks of the river are bordered by mountains of gentle slope, where woods, plains, maize-fields, and banana plantations alternate. The majority of the villages are built on the hillsides, and not by the river, and thereby present the appearance, from a distance, of châlets. The land seems to be very fertile. The villages on the river-banks are pallisaded in front, and have rudely constructed watch-towers (in cotton-trees) in two or three places, which have given rise to the legend regarding aërial villages. Bananas, sugar-cane, and maize are plenteous. Up to the Belly Rapids the natives present the same type as below Zongo,—the head shaven, excepting the nape of the neck, trimmed moustaches, giving them a military appearance, and no tattooing on the face. These people received the expedition in a most friendly manner. Above the Belly Rapids a new people are found, the Bakombe, who are reported to populate a large area in the interior, between the Mobangi and Congo. The stranger is first struck by the arrangement of their hair, as the most distinguishing mark of the Bakombe from their neighbours ; they train it to grow in various ways, some in the form of a chignon, some after the fashion of the Monbuttus, and others in long queues extending down their backs for nearly two mètres in length.

At Mokuangaï, the river sweeps down from the north-east, with a breadth of from 800 to 900 mètres, and a mean depth of 4 mètres. For about 50 kilomètres of its course it preserves this general direction ; it then makes a gradual bend, coming finally from due east, a direction which it maintains as far as the extreme point reached by the *En Avant*, and for about another 275 kilomètres. In all this part of its course the river is named by the natives the Dua. It receives no affluent. On the right bank the rising ground abruptly disappears, on the left bank are a few small hills, on which grassy plains alternate with woods. At first sight the country appears to be uninhabited, because the villages are situated from 2 to 300 paces inland, but the appearance of the boat brought out the natives in swarms. M. Van Gèle attests to the abundance of provisions, which he describes as greater than in any other spot visited by him. "In fact," he says, "it is one of the most fertile and populous districts I have seen in Africa." The natives on the right bank belong to the Buraka and Maduru tribes, those on the left bank to the Bakangi, Mombati, and Banzy. In general, these natives shave a portion of their heads, so as to form the design of a triangle, of which the forehead is the base. The lobes of the ear are greatly elongated, in order to hold the earring ornaments of copper wire rolled five or six times together.

In this part of its course the Mobangi-Dua is a great river studded with islands, the greater number of which are cultivated and inhabited. Iron is admirably wrought in the whole Mobangi district ; the natives use this metal

in the construction of their spears, knives, hatchets, hoes, ornaments, etc. Ivory, though abundant, is little worked, if we except the Banzy, who use it for their bracelets, *pélelés*, etc. The whole population received the expedition well, and offered to trade; neither the steamer nor the discharge of fire-arms appeared to frighten them.

In longitude 21° 30′ the river receives the affluent Bangasso on its right bank. This river (according to the *Mouvement Géographique*) is probably the water-course formed by the union of the rivers Engi and Foro, which were explored in their upper courses by Lupton Bey; but, between the Bangasso and the Lobay, the latter of which joins the Mobangi to the south of the Zongo rapid, no tributary stream of any importance was discovered. On the left bank this exceptional phenonemon is still more marked; above the confluence of the Nghiri (a little north of the equator, on the left bank of the Mobangi) no single left-hand tributary was observed, as far as the 22d degree of longitude, a distance of some 800 kilomètres. It would appear, therefore, that beyond the confluence of the Mbomo and Bangasso, the Mobangi must flow at the bottom of a very narrow valley, confined between the watersheds separating the basins of the Shari, Bunga, and Mongalla.

Above the confluence of the Bangasso, the villages of the Mombongo and Yakoma were passed, and here the natives assumed a different attitude towards the expedition, making hostile demonstrations at every advance. The *En Avant* was here further impeded by numerous rocks and banks, which added to the difficulty of navigation, and finally she struck a rock. The vessel was lightened, in order to repair the leakage, and the stores landed under charge of Lieut. Liénart and some soldiers. The Yakoma natives, who at first were pacific, vehemently attacked the party and killed two men, but were eventually repulsed. Seeking refuge on an island, the whole party was again attacked, by sea and land, by 50 or 60 war-canoes. The natives had evidently taken the expedition to be Sudanese, who had penetrated to this part of the Welle. They were repulsed with heavy losses, but the expedition was forced to return.

The furthest point reached by Van Gèle and his party was in longitude 21° 55′. Dr Junker's furthest (on the Welle) was 22° 55′. It therefore results that some 111 kilomètres (1 degree) of the river's course have yet to be explored and made known. The latitude was exactly the same in both cases (4° 20′), where the river continues to flow from east to west, having a breadth of some 2500 mètres. It is in this unexplored course of the river, in about 22° longitude, that the Mbomo, coming from the ENE., must join the right bank of the Mobangi-Welle.

With great difficulty, and some slight mishaps, in consequence of the river having fallen 3 mètres, the *En Avant* made her return voyage, arriving at Equator Station on 1st February. We are indebted to the *Mouvement Géographique* for these interesting particulars.

AMERICA.

Californian Coast Currents.—The *Bulletin* of the Californian Academy of Sciences (1887, p. 337) contains a paper by Dr. C. M. Richter on the currents of the Californian coast. In general, the surface waters flow in a SSE. direction. A current of some 3 to 10 miles broad flows close to the shore in a contrary direction, carrying the dark sediment from the Sacramento River. During the winter storms these surface currents are often greatly deflected from their course. The deep-sea currents are extremely irregular. Dr. Richter doubts the

connection between the Californian and East Asiatic Kuro Sivo currents, but recognises the dependence of the climatic conditions of the American West on the ocean currents.—*Globus*, No. 11, 1888.

Delimitation of Misiones Territory.—The members of the Commission for the demarcation of the Misiones limits, after an absence of nine months, have returned to Buenos Ayres. With regard to the results of their labour, the *Buenos Ayres Standard* (7th April, 1888) learns that "the limits have been fixed in accordance with the stipulations of the International Treaty. The triangulation of the central 'Cuchillas,' which cover 9000 square miles of territory, was effected by the 'Direccion General,' composed of Baron Capanema and Colonel Garmendià with their respective assistants. The headquarters of the mixed Commission were at Palmas. The staff was divided into three parties: the first took in hands the rivers Pepiri and San Antonio; the second the Uruguay, from the mouth of the Pepiri to the Pequiri-Guazu; and the third the Rio Chopin as far as the confluence with the Iguazu. The surveys were effected with the most delicate accuracy, and the maps drawn up are perfect in every detail."

AUSTRALASIA.

Queensland.—Our Corresponding Member, Mr. J. P. Thomson, writing from Brisbane on 30th January 1888, says:—An overflowing artesian well of fresh water, which for volume of discharge and quality of water is probably unrivalled in Australasia, has been discovered by means of boring operations with an American drill at Barcaldine, a town situated on the right bank of the Alice River, in southern semi-tropical Queensland, in latitude 23° 33′ S. and longitude 145° 18′ E. The site of the well is about 100 yards north-west from the Barcaldine railway terminus, and at an elevation of 953 feet above sea-level. The boring operations were conducted for the Government by contract with, and under the personal supervision of, Mr. Loughead, an American. The bore, which is 11 inches in diameter, cased with 10-inch tubing for the first 307 feet, and thence to the bottom 8 inches in diameter, without casing, is 691 feet 9 inches in depth. The water, which was found at a depth of 645 feet, rose rapidly to the top of, and poured 1⅛ inch over, the casing which, during boring operations, had been 2 feet 8 inches above the surface of the ground. The clearness of the water and its uniformity of discharge,—in a comparatively dry wilderness such as the surrounding country, producing in the beholders feelings of admiration,—very much resembled a huge glass dome placed over the top of the bore. During an official inspection for test purposes, the water, by means of 10-inch tubes, was conducted to a height of over 12 feet above the surface of the ground without sensibly diminishing its flow. The maximum volume of discharge of the water has been tested and found to be 73,092 gallons per hour, and its temperature 101° Fahr. This high temperature would indicate that the water probably traverses a deeper strata than that in which it was tapped. It is probable that the supply originates from a source located in the country to the east, which rises to an elevation of about 1200 feet above sea-level. It is intended to convey, by means of pressure, a supply of water sufficient for the requirements of the town and the railway, and the surplus will most probably be used for irrigation purposes. The boring operations occupied a period of about four weeks, and the total cost amounted to only £775. Consequent upon the discovery, available land in the town and the district is eagerly sought after, and the prices realised are unusually high.

New Guinea.—Mr. J. P. Thomson, our Corresponding Member, sends us the following communication, dated Brisbane, 11th March 1888:—Captain J. M. Hennessy, of the Mission schooner *Ellangowan*, a short time ago returned to Port Moresby from a trip to the western part of the south coast of British New Guinea, and has furnished the Queensland Branch of the Royal Geographical Society of Australasia with a Report, which was read at their February meeting. Captain Hennessy's first destination, after leaving Yule Island, was the mouth of the river Vailala (or Annis—Rev. J. Chalmers), in the Gulf of Papua, approximately in lat. 7° 57′ S. and long. 145° 26′ E., being one of the numerous delta mouths comprised within the territory said to have been explored by Mr. Theodore Bevan. The passage across the bar of the river mouth was successfully accomplished, and the river, which proved to be broad and deep, was examined for some distance up. After the *Ellangowan* cast anchor, the natives, who proved to be peaceful and friendly, crowded in great numbers to see the first vessel of 40 tons which had ever entered their river. Captain Hennessy's party, after examining the lower section of the river, visited the village of Opa, where the inhabitants had never before seen white men. They exhibited indications of great fear, and had their bows and arrows ready stacked at easy distances from their houses; they, however, soon returned the pacific advances of the party, and became very friendly. They were a well-built set of men, and although their average height did not exceed 5 feet 4 inches, their chest measurement averaged 34½ inches. The party, after leaving Opa, next proceeded on their journey westward to Orokolo, which is the name of a large district containing many villages, and thence to the west of the large river delta district; their destination was Maipua, the cannibal village, which could be reached only by traversing two rivers and numerous large creeks. After they had crossed the Arere, which is a grand river, they left it by a large creek, and navigated through a district completely cut up by numerous creeks, both large and small, and thence into the Aivai River, which, like the Arere, is a fine broad stream. Leaving this river they proceeded up the Maipua creek, and thence to the cannibal village of Maipua. The village is very large, and built on both sides of the creek, with two well-constructed bridges for communication. The *elamos*, which are a kind of bachelors' club-houses, here are very large and numerous, and the one at which they put up, which they estimated to be 75 feet high at its entrance, was divided into eight partitions, with a path down the middle to "the dwelling of the gods," which is at the extreme lower end. Between each partition are hung the dancing masks, or *kaiva kukus*, which are grotesque imitations of the features of men and animals, and which are worn over the head; some of them are 8 feet high. On rows on each partition are arranged in lines the skulls of the victims whom they have eaten, the majority of the skulls being beautifully carved. There were in this *elamo* alone over 250 skulls, and in every other *elamo* in the village there were smaller numbers proportionate to the size of the building. Below these human skulls were arranged in profusion skulls of alligators, pigs, dogs, etc., all of which animals these people eat. These Maipuans have a very bad name on account of their man-eating propensities. The men have mostly two or three wives, so called as they live in one house, with a separate partition for each wife. Leaving Maipua, they next proceeded to the Panaroa River, approximately in lat. 7′ 49′ S., long. 145° 06′ E., which, with the Avei and Arere, is one of the mouths of a very large river, the Wickham. There are other mouths further west. The mouth of the Panaroa forms a large and secure harbour, which Captain Hennessy named Bloomfield Harbour, and is available as a port of refuge or trade. From its centre may be seen the Aird,

Charleton, Gill, and Alexander, Hills, which are found on the German chart published in 1885 by Frederichsen, under these names, but which appear on Mr. Theodore Bevan's map, showing the discoveries made by the *Victory* expedition in 1887, as Stanhope Range. Also is seen the Sir Arthur Gordon Range and Chester Hill, which appear to have also suffered a change of nomenclature at Mr. Theodore Bevan's hands. The *range* is called by him Mounts Brassey, Wynne, Barkly, M'Arthur, Ferguson, Paul, etc. Captain Hennessy returned to and surveyed Anderson Harbour, at the mouth of the Vailala River, after which they sailed for Port Moresby.

ARCTIC REGIONS.

Discovery in the Arctic Ocean.—*Ymer*, the organ of the Stockholm Geographical Society, announces an important discovery made last year in the Arctic Ocean. "During the summer of 1887, the sea was quite free from ice round the shores of Novaia Zemlia and Spitzbergen. Profiting by these favourable circumstances, the Norwegian captain, Edward H. Johannesen, reached an island situated to the east of North-East Land (Spitzbergen). This land, covered by high plateaux, of 627 mètres in altitude, is situated in 80° 10′ N. lat., and 32° 3′ E. long. (Greenwich). It is probably the same island as the *Hvide Ö* (White Islet), observed by Captain Kjeldsen, and the land seen on 28th August 1884 by Captain Sörensen (vide *Compte Rendu*, 1884, p. 158). This discovery is very important; it practically confirms the existence of an archipelago uniting Spitzbergen to Franz Josef Land. This archipelago would prevent the polar ice from descending into the Barents Sea, and would in consequence exert a considerable influence on the climate of Northern Europe."

The Norwegian Expedition to Greenland.—Dr. Fridtjof Nansen, of Bergen, and the members of his expedition left Leith on 9th May, for Reykjavik (Iceland), where they will go on board the Norwegian sealer *Jason*, which has been chartered to convey them at once to as near a spot as the ice-conditions will allow on the East Coast of Greenland in about 66° N. latitude. If the shore cannot be approached, the expedition will be landed on the ice, and will endeavour to make their way across to land. Once landed, a "cache" will be made, consisting of provisions, ammunition, etc.; and, as already stated in the Magazine (vol. iv., page 222) a route across the inland ice will be struck in the direction of Christianshaab and Disko Island, on the West Coast. This route is some 400 miles in length, and the journey may be performed in one month or six weeks. Provisions for two months will be taken. If the expedition is forced to return to the point of departure on the East Coast (where no hope of regaining the ship will be left, but in the neighbourhood of which are the Anmagsalik natives), Dr. Nansen is confident that he and his companions would be enabled to sustain life for over one year (living as the Eskimo live) until they worked their way south, by way of the coast, to Cape Farewell. This, however, is a resource he will not hold out to the expedition, the prospect of which is to succeed or starve.

Dr. Nansen's companions are Lieutenant Dietrichson and Mr. Sverdrup, the latter being well acquainted with navigation. In addition Dr. Nansen takes with him two Laplanders from Karasjok and a Mr. Christiansen, all of whom are thoroughly accustomed to snow-shoeing—the mode by which they hope to cross the inland ice, dragging their impediments on sledges. The expedition is well equipped with scientific instruments for taking physical observations, all of which have been tested, and the leaders have been instructed in their use. These include one small altazimuth, with tripod stand; one pocket sextant,

with mercury horizon; three pocket chronometers; three azimuth compasses, with stand; three pocket aneroids; two boiling-point thermometers, as a check on the aneroids; and six sling thermometers. A photographic apparatus, with two hundred plates, has also been taken. The travelling outfit includes a boat, two sleeping bags, a tent, five sledges (on long runners, made as *skï'u*, or snow-shoes) and provisions in a condensed form. Their instructions are to take altitudes of the sun, to compute latitudes and longitudes as well as azimuths, and to make frequent observations, in accordance with the international scheme, in meteorological and other physical phenomena. During their brief stay of two days in Edinburgh, the expedition was very heartily received and encouraged in their arduous undertaking. At a dinner at which they were entertained by Dr. John Murray, Dr. Alexander Buchan pointed out the important services the expedition was likely to render to meteorology and allied sciences; he said that, as a very large number of the Atlantic storms were either generated or much increased in intensity to the south of Greenland, meteorological observations in the interior (especially if taken hourly at a particular place) could not fail to be of the utmost importance: in particular he claimed attention to the direction and force of the wind, and readings of the dry and wet bulb thermometers. Dr. Murray pointed out, what is not generally known (and what might have saved several lives in the late U.S. Arctic Expedition) that a small tow-net dropped under the ice would in a short space of time gather sufficient *crustacea* to afford a good meal.

Dr. Nansen has made a provisional promise, in the event of his expedition returning to Europe, to read a paper on its results to the members of the Royal Scottish Geographical Society.

ROUTES, RAILWAYS, CANALS, ETC.

The Eastern European Railways.—The approaching inauguration of the new line of rails which, running from Pirot in Servia to Tatar Bazardjik in East Rumelia, will place Constantinople in direct railway communication with Calais is an event (says the *Times* of 2d May) of the greatest European importance. The 13th of May has been appointed for the inauguration; but, the Bulgarian company which has contracted for the line from Zaribrod to Vakarel having neglected to comply with certain formalities required by the Société des Lignes de Raccordement, which is responsible for the East Rumelian strip, there will possibly be a new delay.

It was at the Berlin Congress that the completion of the Eastern Railways was decided as a matter of obvious necessity; but the Russians, who remained masters of Bulgaria for some years, were not eager to construct a line which they believed would be favourable to Austrian trade, and, further, give Austria great facilities for pouring troops into the Balkan Peninsula. So nothing was done until 1883, when the Conférence à Quatre (consisting of delegates from Turkey, Austria-Hungary, Servia, and Bulgaria) met and resolved upon a plan of operations. Austria-Hungary undertook to finish the line then in construction between Budapest and Belgrade; Servia was to carry on this line to Nish, and thence to construct two lines, one to Zaribrod, and the other to Vranja, for Salonica; Bulgaria was to lay rails between Zaribrod and Vakarel, on the East Rumelian frontier; and Turkey was to complete the work by a junction of the Vakarel line with that running to Constantinople by way of Philippopolis and Adrianople.

From Vienna to Salonica the distance is 1252 kilomètres, and about 35 hours

will be required in the transit, as the rate of speed through Turkey is (at least for the present) not to exceed 35 kilomètres an hour, including stoppages. There is to be at least one train a day from Vienna both for Salonica and for Constantinople, and the trains are to run straight through, which means that, on the Constantinople line, passengers coming from Bulgaria will no longer have to break their journey by an 18 hours' halt at Adrianople, as was the rule till now. The distance from Vienna to Constantinople is 1602 kilomètres, and the journey will take about 42 hours, instead of 60 hours as at present by the Varna and Black Sea route. The journey from Paris to Constantinople will therefore be performed in about three days and a half; while four days will suffice to carry passengers from London to the Ottoman capital. The suppression of the 16 hours' sea-passage from Varna to the Bosporus will be a great boon, not only as regards the comfort of passengers, but as concerns the regularity and speed of the postal service with Turkey, for the frequent storms in the Black Sea made the length of the passage always uncertain. The annual average of passengers between Vienna and Constantinople by the Varna route has been during the last few years about 3000. It is not to be doubted that the number will henceforth be enormously increased; in fact, Vienna is expected to benefit considerably by the change as a half-way resort for tourists.

MISCELLANEOUS.

A new exploration in **Indo-China** is being carried out by M. Fournereau and a large expedition.

What appears to have been a **Lake-Dwelling** was last month discovered during excavations at Oban.

The Annalen der Hydrographie, etc., Heft iv., 1888, gives a long list of places in **Netherlands India**, with their latitudes and longitudes.

The expedition into Batangaland of **Messrs. Kund and Tappenbeck** has met with a serious check. In a contest with the natives both explorers were wounded.

The *Zeitschrift für Ethnologie* (Heft vi., 1887) contains (p. 624 *et seq.*) a valuable paper by Herr Mense, on the anthropology of the peoples of the **Middle Congo.**

In the first days of March, 1888, **Copenhagen** was entirely cut off from its communications with the outside world, owing to violent snow-storms and an extremely low temperature.

The text of M. Caron's address on the results of the recent French expedition to **Timbuktu** (see *S.G.M.* vol. iv. p. 161) is given in the *Compte Rendu*, Paris Geographical Society, Nos. 7 and 8, 1888.

Our Honorary Member, **Baron Ferdinand von Richthofen**, whose death was reported last March by British and foreign newspapers, writes to us to explain that the death of a near relative gave rise to the mistake.

The results of the borings undertaken by the Royal Society in the **Delta of the Nile** prove that at Zagazig no rock exists at a depth of 345 feet, at a depth of 45 feet at Kasr el Nil, at 84 feet at Kafr Zayat, or at 73 feet at Tantah.

The Imperial Post Office has issued an invitation for tenders for "laying, maintaining, and working a telegraph table between Halifax (Nova Scotia) and **Bermuda**," in return for a subsidy to be granted by the Imperial Government.

We are officially informed that the **Christmas, Penrhyn,** and **Fanning Islands** have been taken formal possession of by Great Britain. The Island of Ascension has been abandoned as a naval station and sanitarium, but remains a British possession.

The *Buenos Ayres Standard* of 7th April 1888 announces that 300,000 North American Negroes, with a capital of two million dollars, and under the direction of a syndicate, are preparing to emigrate to **The Chaco** and form an agricultural community.

Dr. Meyer, whose recent ascent of **Mount Kilima-njaro** we have referred to (p. 52, vol. iv.), has made arrangements to conduct another expedition from the East Coast of Africa to the German portion of the Kilima-njaro district. He will be accompanied by Dr. Baumann.

It is reported that General Przhevalsky, the famous Russian explorer, intends to leave St. Petersburg in August next for a two-years' expedition into **Tibet,** his chief object being to reach Lhassa. He will take with him an escort of twenty-eight persons, of whom twelve will be Cossacks.

The Brazilian Chamber of Deputies has (according to a Reuter's telegram, dated Rio de Janeiro, 10th May) voted the immediate and unconditional **Abolition of Slavery in Brazil.** If the above vote is carried out by the Upper Chamber, and becomes law, nearly one million of slaves will be set free.

NEW BOOKS.

Natural Resources of the United States. By Jacob Harris Patton, M.A., Ph.D. New York and London: D. Appleton and Co.. 1888. Pp. xv., 523.

This handsome volume affords much reading of a popular kind. Its intention is admirable, but the scope is so wide that perfect success could not be looked for. An attempt is made "to give the American people a concise narrative of the natural resources of their own country, in *all* their numerous forms." Accordingly forty-eight chapters are devoted to the consideration of the country, the coal, petroleum, and natural gas fields, deposits of the various metals, precious stones, building materials, and salts, the mineral springs and health resorts, meteorology, agricultural produce, ocean resources, water-power, and land laws. The arrangement appears to follow no definite system, although it is clear by sub-division; and the whole book bears traces of being a rapid compilation from the ninety-four official publications of States and Territories to which the author acknowledges his indebtedness. From the style of the work, we think that it may prove of greater interest to strangers than to citizens of the United States. It abounds in racy anecdotes illustrative of the discovery of new fields of natural wealth, and throws quite a charm round the nomenclature of the new "cities" of the West. Thus, a daring prospector pushed into the wilds of Arizona ten years ago, in spite of hostile Indians and against the advice of friends, who prophesied that he would only find his tombstone. He discovered great silver deposits there, and founded the town of *Tombstone*, in memory of the kind of encouragement he had received. Attention is certainly directed to a great many important points; but the compiling, although laborious, is not always well done. The compiler is obviously unacquainted with the details of geology and chemistry, and falls into many grave errors of description, which make those who can detect them smile, but

might easily mislead the less instructed. The statistics of foreign countries, occasionally introduced for comparison with the abundance of the United States, are occasionally much behind date, and sometimes misleading. Thus the British coal supply is calculated to last only one hundred years from 1863, Jevons' estimate ; while the work of the Parliamentary Committee of 1871, which gave six hundred years as the probable duration of supply, is not referred to.

The least pleasant feature of the book is the by no means tacit assumption that an all-wise Providence has selected the United States for the ultimate home of civilisation, and has accordingly endowed it with all the natural elements of greatness in measure far exceeding any other land whatever. This leads to an air of special pleading that places geographical facts in a light where they shine with a meretricious lustre. Few geographers will be prepared to concede that the north-and-south arrangement of American mountain ranges—the configuration which admits of the blizzards of the north-west and the bitter Nortes of Texas—is as powerful a teleological argument as the author considers it.

Spite of the faults, Dr. Patton has produced an interesting book, and one likely to stimulate curiosity in a very important department of practical knowledge. It would be well if the United Kingdom were described in a similar manner, with this volume to guide and caution the writer.

A Popular History of the Mexican People. By Hubert Stowe Bancroft. Pp. viii., 632. London : Trübner and Co., 1888.

In taking up a history of Mexico, it is well to remember that the Confederate Republic has an area more than six times that of Great Britain and Ireland ; and that few regions comprise within equal limits so great a variety of climate, soil, and vegetation. Even in the portion lying within the tropics, the higher plateaux may fairly be called cool, and grow wheat and the hardier grains ; the lower plateaux produce the olive and the orange ; while in the lowlands at the same latitude, luxuriant but pestilential, the typical fruits of the tropics grow abundantly.

It is not, however, the great fertility of large areas that mainly attracts our interest, nor the enormous mineral wealth of the land, nor the indefinite possibilities of future development of a country capable of sustaining a population vastly greater than the ten millions who now inhabit it. Every one knows something of the strange civilisation of the ancient Mexicans, their magnificent palaces and temples, their dignified and imposing ceremonies, their extravagantly bloody and odious human sacrifices. The Spanish conquest and its audacious, unscrupulous hero Cortes ; the cruel, treacherous, ruinous administration of the vice-regal period ; the various fortunes of the revolutionary wars under patriots like Hidalgo, the curate of Dolores, or self-seeking time-servers like Iturbide ; and the short-lived and disastrous empire of Maximilian, make Mexican history a tragedy in innumerable acts—a tragedy varied and picturesque, indeed, with elements noble and heroic as well as repellent and terrible.

Of all this, and much more, does Mr. Bancroft treat, who is admittedly the most authoritative and copious of authors on the history of the States on the Pacific Coast of North America. Of the ancient Nahua inhabitants of Anahuac, whether Toltec, Chichimec, or Aztec, we have a singularly complete picture—of their manners and customs, their food, drink and raiment, their dances and games ; of their beliefs, of the gods Tezcatlipoca, Quetzalcoatl, Huitzilopochtli,

Xiuhtecutli, and the rest. The language of the Aztecs, most perfect of all American languages, equalled many of the noted European and Asiatic tongues, and surpassed many of them, Mr. Bancroft says, in elegance of expression. At the same time, he admits that the length of the words was a defect. This may well be seen in the Aztec form of the sixth petition of the Lord's Prayer, which we quote from Mr. Bancroft :—"Macamoxitechmomacahuili inicamo ipan tihuetzizque inteneyeyecoltiliztli" (literally "thou-not-us-lead that-not in we-fall in-temptation"). The art of the Aztecs, their architecture, carving, picture-writing is fully described and copiously illustrated.

From a period when the gods walked freely in and out of the temples of Anahuac, and wrought signs and wonders for their favourites, down to the second presidency of Porfirio Diaz, which began 1884, Mr. Bancroft guides his readers. He takes a somewhat optimist view of the progress of the past few years, expects still greater progress, and fully analyses the elements of present and future wealth. In the century after the conquest, the New World shipped to Spain silver enough to build a bridge across the Atlantic a yard and a half in width, and two inches in thickness. Mexico has furnished approximately one-half the world's supply of silver during the eighteenth and nineteenth centuries. The total yield in Mexico of the precious metals (mostly silver) between 1537 and 1880 must, on the lowest reasonable estimate, have amounted to £620,000,000. But Mr. Bancroft seems to hope that this is little compared with what Mexican agriculture, mining, and manufactures may under judicious management attain to. The drawbacks of Mexican politics and society are very frankly stated ; and Mr. Bancroft's impartiality is shown in the very unflattering account he gives of the most common representatives of the United States citizens found in Mexico, and his unqualified condemnation of the United States policy in the war with the sister republic.

The work is readable throughout ; but it is somewhat unequal, and reveals here and there the fact that it is condensed from the six volumes of Mr. Bancroft's larger work. These six volumes fall into Mr. Bancroft's plan, formed many years ago, of writing the history of all the States on the Pacific Coast from Panama to Alaska, in 39 volumes. Mr. Bancroft, we understand, employs many writers to digest the information contained in his vast library of 50,000 volumes of collections on this subject ; he then revises the whole, and writes the most important chapters. About half of his stupendous enterprise is already accomplished. This volume is one of the numerous "chips" or *parerga* from his workshop.

The illustrations are very numerous, and many of them are both instructive and pretty. Some are, however, so ill-produced as to be almost useless ; and it is odd that, while there are upwards of twenty section maps of districts, and still more numerous plans, there is no general map of Mexico. The index is long, but hardly exhibits fully the vast amount of matter in the work, which, as is obvious from typography and spelling, has been printed from American plates. A few, very few, odd misspellings or blunders occur : "coat of mail of Mexico" for "coat of arms" ; "Napoleon" twice in one page in referring to the French Emperor. For most European readers, we feel confident that this one volume will give an ample view of Mexican history.

Tropical Africa. By Henry Drummond, F.R.S.E., F.G.S. With Maps and Illustrations. London : Hodder and Stoughton, 1888. Pp. 228. *Price* 6*s.*

The first glance through Professor Drummond's new book gives one the impression of its being a mere compilation, or so many "leaves" from a traveller's

note-book, and it requires to be read in order to discover the system upon which the book has been constructed. "Tropical Africa" is too wide a term to designate its scope; the book would more appropriately have been called "Eastern Equatorial Africa." In regard to the region of the Great Lakes, as far north as Tanganyika, Professor Drummond gives us, under different chapters, all that the general reader may care to know of its geography, ethnology, and natural history. His descriptions, partly derived from his own travels and observations and partly a summary of the work of others, are characterised by a grace of style which affords charming reading; as a *cicerone* Professor Drummond shows himself both sympathetic and well-informed. His pages are full of "happy thoughts" and "happy hits," and, being stripped of their scientific garb, present to the reader (especially in the chapters on the "White Ant" and "Mimicry") a most alluring peep into the natural history of an almost virgin field of observation. His theory in regard to the White Ant is, perhaps, the most important contribution; he claims for this family of the *Termitidæ* the functions in the economy of Nature, in Tropical Africa, which Darwin assigned to the earthworm in more temperate lands; and as Nature's agriculturists they appear to warrant the author's conclusions.

Professor Drummond has given us a pleasing picture of the country and its inhabitants, and of the usual experiences of a European in visiting them. He has sketched it in broad lines, so we shall not question the details, some of which are open to criticism. His "Political Warning" we have already heard from other quarters; his diagnosis of the slave-trade disease and the specific he recommends for its cure, though not original, are well stated.

Several maps by Bartholomew illustrate the book, and add greatly to its value. The two maps published by the Society last March are given without recognition of their source, and their "provisional" colouring has unfortunately been allowed to remain in this permanent form.

Africa: in kartographischer Darstellung von Herodot bis heute. Eine Hauptkarte und 17 Nebenkarte. Entworfen und mit einem begleitenden Texte versehen von Professor Dr. Friedrich Umlauft. Wien, Pest, Leipzig: A. Hartleben's Verlag, 1887. *Price* 2*s.*

Messrs Hartleben, the publishers in Vienna, have sent us a copy of their *Africa*, showing the progress of geographical discovery from Herodotus to the present day. This most interesting publication, by Professor Friedrich Umlauft, reproduces the maps of Herodotus (450 B.C.), Ptolemy (150 A.D.), Edrisi, the Arab geographer (1154), Martin Behaim (1491-93), Mercator (1541), D'Anville (1761), Reichard (1820), Stulpnagel (1850), and of other less important authorities. The maps, which are accompanied by a descriptive text, are well executed. To the student of Africa, such a series of maps, in so convenient a form, cannot fail to be of the highest value and assistance.

Eine Africanische Tropen-Insel; Fernando Po und die Bube. By Dr. Oscar Baumann. With 16 Illustrations and a new Map. Vienna and Olmutz: Eduard Holzel, 1888.

After spending a year with Dr. Oscar Lenz in exploring the Congo, Dr. Baumann arrived at Fernando Po in September 1886. He has now published a monograph of 142 pages, which should be received with much interest. His description both of the island and of the people is written in a very interesting manner, and it is evident from a perusal of this work that he is a well-trained

and highly educated explorer ; indeed we may say that his book is written upon lines which should be followed by every traveller. Perhaps the habits, customs, and superstitions of the natives are best treated, although the flora and fauna have not been forgotten, and a chapter has been written concerning the commercial importance of the island. The illustrations are good ; the map which accompanies the volume is excellent, and the appendix, giving a list of all the books which have been written on the subject, is of value. We hope that this book may be translated into English, for, as the whole of the trade with the island is in British hands, a knowledge of its capabilities and of its people should be welcome.

Japanese Homes and their Surroundings. By EDWARD S. MORSE, Director of the Peabody Academy of Science. With Illustrations by the Author. London: Sampson Low and Co., 1888. Pp. 372. *Price* 10*s.* 6*d.*

This is the second edition of a work that has already been well received by the public. As a careful and ably-written account of all that pertains to Japanese houses and their immediate surroundings the work is of considerable value to students of ethnology, as well as to those interested in art and architecture. The admirable illustrations by the author, of which there are over 300, greatly assist the reader in gaining an accurate conception of details. The book is well printed and artistically finished.

Meyer's Konversations-Lexikon. Bde. IV.-VII. 4th Edition. Leipzig, 1886-1887.

These volumes cover the articles from *China* to *Hainichen*. The general nature of this work has been already sufficiently indicated in vol. i. pp. 398-399. Here the only remarks we have to make of a general nature are two. One of the most serviceable features of *Meyer's Encyklopädie* is the fulness of its rubrics or separate articles. Yet in the volumes before us this feature has been allowed to run to excess, many headings being merely explanations of the meanings of words which could be obtained from any ordinary etymological dictionary, for instance, *cranium*, *delogement*, *firmität*, *grand-père*, etc. etc. As far as the geography of these volumes is concerned, we find valuable articles on China, Chiwa (Khiva), Congo, Corsica, Costa Rica, Cuba, Cyprus, Dalmatia, Dänemark (Denmark), Deutschland (Germany), Ecuador, Elsass-Lothringen (Alsace-Lorraine), England, Europe, Finnland, Frankreich (France), Greece, Gross-Britannien (Great Britain), Guatemala, Guayana, Guinea. Besides these there are a multitude of smaller notices. The scientific geographer will turn also with especial eagerness to such articles as *Ebene* (Plain), *Fluss* (River), *Gebirge* (Mountain), *Erde* (Earth), *Erdkunde* (Geography), and will read with great interest the article on the glacial period (*Eiszeit*), which has a map showing the areas of glaciation both at that epoch and at the present time. Another useful map is one (under *Datumwechsel*) showing the line of demarcation between those parts of the earth which reckon time according to the Portuguese (from west to east), and those which reckon it according to the Spanish (from east to west), directions of sailing round the earth. The maps are clearly and well drawn, and appear to be accurately brought up to date. Amongst those which are new, or not usually found in general atlases, are maps of Cyprus, Congo, and the Guinea Coast. A word of praise must also be given to the plans of several large towns.

A Dictionary of Place-Names, giving their Derivations. By C. Blackie. Third Edition, revised. London : John Murray, 1887. *Price* 7*s.*

This is a new edition of Blackie's Dictionary of Place-names. It is one of those books that an intelligent traveller, especially through the Highlands, cannot fail to want. It ought to be in the hands of all who desire a real knowledge of the dim and distant past. Like the fossil in the heart of the rock, the name of a place bears its history at first-hand in itself, and thus connects us directly with its genesis. We ought to study a place-name like the features of a country-side. In reading through this small volume, one feels the "touch of nature which makes the whole earth kin :" for we have the cognate names of so many and varied languages brought together, and thus are able to recognise very often their underlying resemblances. School Boards would do well to recommend it to teachers. The book is full of interest for the tourist, as is well pointed out in the preface by Professor Blackie. It is reliable, accurate, and well arranged.

A Handbook for Travellers in Lower and Upper Egypt. Seventh Edition. Thirty-three Maps, Plans, etc. London : John Murray, Albemarle Street, 1888. *Price* 15*s.*

So much has happened in Egypt since 1880, when the sixth edition of Murray's *Handbook* appeared, that travellers in that country could not but feel the need of a new edition of this excellent work. Since that time many discoveries of importance have been made, and the British occupation has led to many changes which even the most casual visitor cannot fail to notice. It is unnecessary to say any thing in praise of this edition, for in the main it is marked by that thoroughness which is a characteristic of Murray's *Handbooks.* One or two things, however, may be pointed out in which the *Handbook* seems to us defective. In the interesting account of the Suez Canal, no mention is made of recent changes, and nothing is said of the important questions that have arisen about it. This would not be expected were it not that otherwise the account given is so complete. Again, while the vocabulary is evidently intended for the use of persons who know next to nothing of Arabic, no hint is given as to how the English-speaking traveller ought to pronounce some of the vowel-sounds. It seems to us also that in the description of Cairo the method employed is not the best. It may, perhaps, be more scientific to describe all the mosques or all the gates together, but for practical purposes there can be no doubt that the method employed by Baedeker of describing a locality with all the buildings in it is at least more useful for the man who has but little time to spare. Apart, however, from these blemishes the *Handbook* is excellent ; it is a perfect storehouse of information about Egypt, ancient and modern, and no one who has been in Egypt can fail to realise its value.

Handbook for Travellers in Russia, Poland, and Finland, including the Crimea, Caucasus, Siberia, and Central Asia. Fourth Edition, thoroughly revised, with Maps and Plans. London : John Murray.

The demand for a fourth edition of Murray's *Handbook*, and the enlargement of its size, may be taken as signs that the British tourist is discovering a new world to conquer in Russia. The extent of the revision and enlargement is even greater than at first appears to the eye, for in order to find room for an account of routes and towns which have been rendered accessible by the development of railways and other means of communication, and yet preserve the work from becoming too bulky to be a "handbook," the historical matter has been

printed in smaller type in the present edition. What device will be adopted when the tourist, pushing his way eastward, demands fuller information regarding such places as, for example, Irkutsk, than nine lines of "history" and about double as much of "topography," it were hard to say. In the new edition, Siberia and Central Asia are dismissed in eighteen pages, so that there is ample room for further increase of information and reduction of type. An initial and serious difficulty in a popular work of this kind is that implied in the spelling of Russian names. Mr. Mitchell has, on the whole, adopted the best and simplest course open to him, in rendering sounds, throughout the portion of the work that relates to Russia proper, "by a simple combination of English letters, pronounced as in the Italian language." In any Geographical work on Russia, and especially in a guide-book, St. Petersburg and Moscow must occupy a formidable amount of space. In the new or in the old capital are centred much of the historical interest and the bulk of the art-treasures of the empire; and to them and from them all routes more or less lead. They take up between them, including excursions to places of interest in their neighbourhood, nearly 150 pp. of the *Handbook*, and to them are assigned most of the maps in the volume. But there are also pretty full and well-written notices of such historic places as Kief and Novgorod, and of great commercial centres like Nijni Novgorod, Riga, and Odessa; the Crimea and its battlefields receive special attention, and Poland and Finland come in for separate treatment at greater length than in previous editions. The topographical, historical, and statistical information appears to have been carefully revised, and with competent knowledge, though here and there errors have crept in. We stop only to mention the discrepancy (arising from confusion of "styles") between the statement in the "Historical Notice" that the advanced guard of the French army first caught sight of Moscow on the 14th September 1811, and the mention in the description of the city, that Napoleon made his entry into the abandoned capital on the 2d of the same month.

Géographie Historique. Par P. Foncin, Inspecteur-Général de l'Enseignement Secondaire. Paris: Armand Colin et Cie., 1888.

M. P. Foncin is well known as the author of a *Géographie Général* which, like the most popular American text-books on the subject, is a Geography and Atlas combined. The present work is a History and Historical Atlas combined, on a similar plan. It contains 48 large maps, fully coloured, and 48 corresponding lessons, so arranged that the map and the relative lesson are presented at one view. There are also numerous small maps, plans, and pictures. The history is universal; that is to say, it embraces ancient, mediæval, modern, and contemporary history. There is an introduction on the territorial formation of the principal civilised States; and at the close of each period there is a review of the history of civilisation during its course. It will be inferred naturally from this description that the historical lessons are very much condensed. In fact, they are mere outlines. For example, one excellent map illustrates the history of France "Before and during the Hundred Years' War." The single page facing it is found to contain the history of two centuries and a half. The only map dealing specially with British history covers six centuries, and the single-page lesson thereon covers the same period. Nevertheless, the summaries are intelligently prepared. It is specially noteworthy that they are not overloaded with names and dates. We are chiefly concerned, however, with the maps, of which we are able to express a high opinion. The periods represented are well chosen, the territorial divisions are accurate, and the maps are well printed and coloured.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ON THE EFFECTS OF WINDS ON THE DISTRIBUTION OF TEMPERATURE IN THE SEA- AND FRESH-WATER LOCHS OF THE WEST OF SCOTLAND.

By John Murray, LL.D. (Edin.), Ph.D. (Jena).

Introductory.

There have been many theories to account for the circulation of oceanic waters, but all these have been for the most part modifications of two principal views. One of these refers the origin of oceanic currents to the action of the trade-winds or prevailing winds of the globe on the surface waters of the sea. The other maintains that equatorial waters, being greatly heated and lighter, stand at a higher level than the cold and denser polar waters, and that, consequently, there is a flow of warm surface waters towards the Poles, which is compensated for by a return flow of deeper layers of water from Poles to Equator.

This latter view, which is called the gravitation or thermal theory, has been upheld in recent times by Lenz and Dr. W. B. Carpenter. It seems more than likely, however, that the difference of level here invoked is very much less than would be produced by the attractions of continental land, by the action of the wind, and by evaporation. The former view, known as the wind theory, has been advocated by Humboldt, Herschell, Croll, and the majority of modern writers. In a recent publication, however, Alexander Agassiz does not appear to consider the wind a sufficient cause for existing currents.[1]

Along with the additions to our knowledge, lately made by the *Challenger* and other expeditions, regarding the depth of the ocean, there has been acquired an altogether new series of facts concerning the distribution of temperature in ocean water at various depths, and these, when carefully considered and discussed, appear clearly to point to the prevailing winds of the globe as the agents chiefly concerned in the pro-

[1] *Three Cruises of the "Blake,"* vol. i. p. 247.

duction of oceanic currents; for it is often more easy to trace currents by the temperature of the water than by direct observation.

While the influence of wind is regarded as paramount, the secondary effects of variations of temperature, of density, of evaporation, of the rotation of the earth, and even the pressure of the superincumbent waters, must not be lost sight of in any discussions dealing with ocean circulation. But these secondary causes are, most of them, largely determined by the movements of the atmosphere; in considering the phenomena of the ocean, it is therefore essential to take account of the superincumbent atmospheric ocean which everywhere rests on its surface; for the composition of ocean water, the currents, the distribution of salinity, density, temperature, and deep-sea deposits can ultimately be connected with the general movements of the atmosphere.

It has been shown by Mr. Buchan's discussion of the *Challenger* observations that the daily variation of the temperature of the sea surface does not exceed 1° F., and also that the yearly variation is very small compared with the large variation over the land surfaces; to the first of these are due land and sea breezes, and to the second the monsoons.

The most important, as well as the most direct effect, of the unequal distribution of temperature over the surface of the oceans and continents is a more or less permanent distribution of atmospheric pressure. There are portions of the earth's surface where atmospheric pressure remains much higher than in adjoining regions, with little variation throughout the year, and from which winds blow in all directions towards surrounding areas. Such an area is that situated between the north of Africa and America; and out of this anticyclonic region of high pressure, observations show that the winds blow in all directions to where the pressure is less. To the westward of North Africa the prevailing winds are northerly and north-westerly; towards the equator, on the south of this anticyclonic area, the winds are easterly, while along the coasts of North America, to the west of this same high-pressure area, the winds are southerly. Similar areas are found in the South Atlantic, in the North Pacific, and in the South Pacific; and in all these regions the general direction of ocean currents is determined and maintained by these winds, with, in some cases, seasonal variations.

In the great bulk of the wind-driven oceanic currents the circulation is horizontal, and the return currents at the surface may in some instances be wholly out of the influence of the original generating winds. Soon after the publication of the *Challenger* observations, it was argued that these afforded evidence of a vertical circulation as well as a horizontal. Dr. Carpenter maintained that the rising of the glacial waters near the equator was due to the meeting of Arctic and Antarctic underflows, but it was at once pointed out by Mr. John Aitken,[1] among others, that this was more probably due to the lifting up of the cold water beneath to supply the place of the water driven forward by the action of the winds on the surface, the rest of the necessary supply rushing in at the sides. All subsequent observations and discussions appear to support this explanation.

[1] "On Ocean Circulation," in *Proc. Roy. Soc. Edin.*, vol. ix., 1874, p. 394.

To the direct and indirect action of the prevailing winds must be attributed the fact that relatively cold water is met with at and nearer the surface along those continental shores from *off* which winds blow, and not along similar shores *towards* which the winds are directed. For instance, the surface water is colder off the western coasts of Africa than off the West Indies, towards which the trade-winds blow, a temperature of 45° F. being met with at a depth of 200 fathoms off the former coast, and at over 400 fathoms off the latter. A like temperature of 45° F. is found at 600 fathoms off the coast of Britain—that is to say, warmer water is encountered at a depth of half a mile off Britain than off the tropical coasts of Western Africa.

The great bulk of the water of the ocean has a low temperature: it is ice-cold at the bottom even under the Equator in the Atlantic, and only a little above that in other oceans. The surface warm water is a relatively thin film, and this film is much deeper towards the western parts of the tropical Atlantic and Pacific than towards the eastern. On the other hand, the layers of warm water are deeper in the eastern parts of these oceans in the temperate regions, where western winds prevail. These facts are more clearly shown on the *Challenger* maps showing the distribution of temperature at 10, 20, 50, 60, 100, and 300 fathoms, than by the surface observations.

This drawing of deeper water towards the surface along windward shores has an important bearing upon the distribution of climates [1] and of marine organisms,[2] which renders any observations concerning the effects of wind on the movements of water of special interest; for instance, the fact that there are no coral reefs off the western shores of Africa or of America is directly connected with this action of the wind.

No detailed observations have hitherto been recorded showing the amount of change effected by the wind with varying velocity in any one locality and within any definite time. With the view, therefore, of throwing some light on the subject, I have embraced any opportunities which presented themselves for making experiments during the past two years on the waters of the western lochs of Scotland, and in this paper I propose to refer to some of the results.

It has been stated that in the open ocean the return current may be, and usually is, chiefly at the surface, rushing in at the sides to supply the place of the water driven forwards by the wind. In some conditions, however, there would appear to be return under-currents in the open ocean, like those observed by Buchanan[3] in the Gulf of Guinea, which probably owe their origin to causes similar in some respects to those which, as we shall see, produce return currents in enclosed lochs.

In a lake or sea loch, as the wind blows over the whole surface of the water, there can be no return current at the surface, so that the supply of water to take the place of that driven forward must come from beneath and as an under-flow.

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1 "On Similarities in the Great Oceans," by J. Y. Buchanan, *Proc. Roy. Geog. Soc.*, 1887.

2 "On Coral Reefs," by John Murray, *Trans. Royal Institution*, 1888. "On Observations in the Indian Ocean," by John Murray, *Scot. Geog. Mag.*, 1887.

3 *Loc. cit.*, page 9.

FRESH-WATER LOCHS.

Loch Lochy, Loch Oich, and Loch Ness.

(Figs. 1, 2, 3, and 4.)[1]

These fresh-water lochs are situated in the line of the Caledonian Canal, running in a north-east and south-west direction along the great fault of the Highlands of Scotland.

Loch Lochy is about nine miles in length, and has a depth in some places of over 70 fathoms. On the 27th April 1887, a series of temperatures were taken along this loch at various depths: the details of these observations are given in the annexed tables, and the distribution of the temperature is represented graphically in Figure 1. A gale had been blowing from the south-west during the previous two days, and on this day had been succeeded by a calm. The range of temperature in the loch was between 41°·7 and 44° F. The lowest temperature was met with at the greatest depth, and the highest on the surface at the north end of the loch, towards which the wind had been blowing. The south end of the loch had a temperature of about 2° colder than the north. During the gale all the warm surface water had evidently been driven to the north end, and there banked up, and now, when the calm had supervened, this warm water had commenced to spread out over the surface of the loch towards the south.

In Figs. 4*a* and 4*b* the distribution of temperature is represented in this same loch on the 7th September and the 9th September, 1887. The whole loch had become considerably heated since the spring months, the bottom water being now 43°·7 in place of 41°·7, and the surface water in some places as high as 56°·8. An inspection of the diagrams shows that on the 7th September (Fig. 4*a*), when the wind had been blowing for some time from the NE., the whole of the warm water was collected towards the southern end, and a current of colder water was being drawn up from beneath towards the northern end. During the 8th September, the wind changed from the east to the south-west, and on the 9th (Fig. 4*b*) was blowing strongly from the latter direction. It will be noticed that the distribution of temperature is now reversed, the warm water being collected at the north end of the loch.

Loch Ness.—This loch has a length of about 23 miles, and a depth of 130 fathoms in the centre. Diagram 2 shows the distribution of temperature in this large fresh-water loch, on the 25th and 26th April, 1887, during a south-west gale, the cold water in this case being collected at that end towards which the wind was blowing.

A most interesting series of observations was made in this loch on the 8th September 1887. A moderate wind had been blowing from the east for several days, and the warm water of the loch had evidently been collected at the south end, as shown by the following observations taken in 42 fathoms, close to the Monastery at Fort Augustus, just about the time of a change of wind; it was calm at 6 A.M., and when the observations were taken at 8 A.M., the south-west wind had just commenced

[1] In the diagrams the vertical scale is very much exaggerated compared with the horizontal.

to blow. Alongside of the observations at 8 A.M. are placed those taken at 6 P.M. at the same spot. The difference of temperature distribution at this spot is represented in the diagrams Nos. 3*a* and 3*b*, the detached portion (Fig. 3*b*) representing the observations at 8 A.M., the warm water being then collected at the south end of the loch as the result of the steady easterly winds that had been blowing on the previous days. After taking the observations at Fort Augustus at 8 A.M., sail was made, and we proceeded before the south-west wind to the north end, a distance of about 22 miles. A series of temperatures were then taken back the length of the loch to where we had commenced in the morning. During this time a great change had taken place; the whole of the warm water had been transferred to the opposite end of the loch from where it had been in the early morning. This change of distribution being represented in the large section (Fig. 3*a*). The two sets of observations taken at the same spot, off Fort Augustus, show the change that had been effected there in the course of ten hours by the action of the wind. At 42 and 31 fathoms the water had become nearly 2° colder; at 21 and 15 fathoms, over 2° colder; at 10 fathoms, 8½° colder; and at 2 fathoms and at the surface over 7° colder.

SERIAL TEMPERATURES.—LOCH NESS, 8th Sept., 1887.

Time	8.10 A.M.	6 P.M.
Wind	W.	WSW.
Force of Wind	3	5
Weather	Overcast	Rain
Sea	Roughish	Rough
Air Temperature	53·5	...
Depth (Fathoms)	42	42
Fathoms.	Temp. Fahr.	Temp. Fahr.
0	54°·9	47°·8
2	54°·9	47°·7
5	54°·5	47°·0
8	54°·4	46°·7
10	54°·6	46°·1
16	47°·4	45°·3
21	46°·5	44°·1
31	45°·2	43°·6
41	44°·8	43°·2

It is interesting to observe that the temperature of the water in the deepest parts of Loch Ness had only become warmer in 120 fathoms by about three-tenths of a degree since the spring observations, while in Loch Lochy, where the depth is 70 fathoms, the temperature had in the same time changed by over two degrees.

It is also worthy of remark that the little Loch Oich, situated between Loch Lochy and Loch Ness, which has a depth of only 12 or 13 fathoms, had a temperature of over 44° throughout its whole extent, and that the water in Loch Lochy was, at the surface and throughout its whole extent, of a higher temperature than the larger Loch Ness. These differ-

ences are due to the combined action of the sun's rays and of the wind on sheets of water differing greatly in depth : in the smaller and shallower lochs the water, heated at the surface by the sun, is mixed up with a much smaller body of water by the action of the wind than in the case of the larger and deeper lochs, and consequently the mass of water as a whole is sooner raised to a higher temperature.

It is probable that the observations here mentioned are directly connected with the early run of salmon through Loch Ness, and up into the little Loch Oich, where there is one of the earliest salmon fishings in Scotland. Indeed it would seem that early rivers are in some way connected with a reservoir of warmer water near their sources, such as in the case of Loch Oich. At all events our observations on the temperature of rivers and of the sea throughout the year do not appear in any way to support Mr. Archibald Young's conjecture that early rivers depend on the temperature of the North Sea and Atlantic in relation to that of the rivers flowing into these seas respectively.[1]

Loch Morar.—This large fresh-water lake is situated between Loch Nevis and the Sound of Arisaig, and is probably the most remarkable loch in the country. It is about 12 miles in length, and the average width is about a mile. The soundings made here by Mr. Buchanan and myself show it to be by far the deepest loch in the country. Its depth opposite Tarbet is 180 fathoms or 1080 feet. There is an area two or three miles in length and about half a mile in width over 140 fathoms in depth. This is the deepest hole on the Continent of Europe except some of the Norwegian fjords. The surface of Loch Morar is only about 30 feet above sea level; so that the bottom of the loch sinks deeper than any of the sea lochs—indeed deeper than the sea bed anywhere about our islands till a distance out beyond the 100-fathom line bordering the Atlantic Ocean is reached.

The temperature observations in the loch, on the 29th April, 1887, showed the deepest water to have a temperature of 42°, while there was a thin layer above 43° near the surface. On the 3rd September, when the observations were repeated, the bottom temperature had risen to 42°·2 or about two-tenths of a degree—just about the same as the rise in Loch Ness during the same period. The surface layers in September were from 48° to 60° F. A strong wind commenced to blow when the observations were being taken in September. A change in the distribution was noticed to be going on, but as the yacht *Medusa* could not be taken into this enclosed loch, the observations had to be made from a small boat, and hence the variations could not be followed and noted.

SEA-WATER LOCHS.

Loch Striven, Loch Fyne, Loch Etive, etc.

(Figs. 5, 6, 7, and 8.)

The mixture of the heated surface layers of fresh-water lochs with the colder water beneath through wind action takes place much more rapidly

[1] *Salmon Fisheries*, by Archibald Young, p. 219. London, 1877.

than in the case of sea-water lochs. In the latter case, the varying density, due to salinity, retards the mixing process to a considerable extent. It has been found, as a result of our observations, in more or less enclosed sea-lochs, or estuaries cut off from the outer ocean by submarine ridges, that in summer the surface layers of water are warmer than the deeper ones, while during the winter months the warm water is at the bottom and the cold water on the surface.

Loch Striven.—This loch is about ten miles in length, and its greatest depth is 42 fathoms. Figure 5 represents the distribution of temperature in Loch Striven, on the 14th December, 1887, during a SW. gale blowing up toward the head of the loch. All the fresh and cold water was banked up in the upper reaches, and at the head there was a temperature of 39°·3 on the surface, and at the bottom in eleven fathoms there was a temperature of nearly ten degrees higher (49°). The surface became gradually warmer towards the mouth of the loch, where the warmer water was being drawn to the surface, and mixed with the colder layers by the wind.

Figure 6 represents the distribution on the following day, a calm having occurred during the night. At the head of the loch there was a coating of ice, the fresh water floating on the surface having frozen during the calm, so that there was a difference of nearly seventeen degrees between the surface and the bottom water in twelve fathoms. It will be noticed that the layer of cold water on the surface had spread over the whole of the loch down towards the mouth, where the temperature was nearly two degrees colder than on the previous day. The warm layers at the bottom had also risen nearer the surface by several fathoms at the upper end of the loch.

Figure 7 shows the distribution on the 19th December, four days later than the observations represented in Figure 6, a light north wind having been blowing down the loch for some time before the temperatures were taken. It will be noticed that all the cold layers of water had been blown out of the loch, and on to the Rothesay shore, where the temperature was lowest. The water on the surface at the upper part of the loch was now about sixteen degrees warmer than it was five days before, and was quite salt and clear, so that the bottom could be seen in two and three fathoms. On the 14th December, when the wind was blowing up the loch, the water at the same spot was brown-coloured and quite fresh, so much so that it was taken on board for cooking purposes.

These three sections thus give an excellent idea of the circulation and variations in temperature that take place within a short time in these partially-enclosed lochs through the action of the wind. And in this connection it may be remarked that these lochs are especially suitable for such observations, owing to the differences of density and temperature which there obtain at various seasons of the year. It is not possible to make similar observations on the open coasts, where there is at similar depths a nearly uniform temperature and density throughout all seasons of the year, brought about by the mixing due to tidal and other currents. Although there may be as great a change and circulation

in these localities through wind action, still it is not possible to note them by any means at present at our command. We have seen, however, that similar effects are produced over wide areas in the great oceans, and are more or less permanent phenomena of the ocean basins.

Loch Fyne, Loch Etive, etc.—Figure 8 shows the temperatures in the deep waters of Upper Loch Fyne during a gale on the 4th and 5th of January, 1888. The wind was blowing from Strachur towards Inveraray. During this time the surface water off Inveraray, and to a depth of several fathoms, was from 39°·5 to 42°, while on the weather shore at Strachur it was 47°·4 from surface to bottom, the warm layers of the deep water being there drawn up to the surface, while all the cold surface layers were banked up around Inveraray.

Many other instances might be given similar to the foregoing ones from other lochs on the West Coast. For instance, some interesting examples might be given from Upper Loch Etive, which is the most completely enclosed of the sea-water lochs. It has a depth of over 70 fathoms, and is cut off from free communication with the sea by the Fall of Lora, at Connel Ferry, and again higher up by a very narrow entrance at Bonaw. Salt water as usual occupies the greater depths, and fresh water very often covers a large extent of the surface. Yet during gales the deep, pure water is frequently drawn to the surface at one or the other end, or along one edge of the loch.

On the 7th June, 1888, when the wind was blowing from the east across the Gare Loch, the water at the surface and to the depth of several fathoms was two degrees colder along the weather shore than on the opposite lee shore, being in one case over 46°, and in the other a little over 48°.

On the 8th June, and the early part of the 9th, there was a calm throughout the Clyde area, and consequently a very uniform temperature in the surface and sub-surface waters. About ten o'clock on the 9th, a slight breeze sprang up from the west across the mouth of Loch Striven. In the course of two hours all the heated surface water had been driven upon the Lamont shore, and cold water was drawn up on the weather shore inside Strome Point, the temperature along this latter shore being about 47° and a little below, while along the former it was from 49° to 51°·3, a difference of over four degrees in some places.

It has also been observed that the water from beneath is drawn nearer to the surface about those places in the length of a loch where the wind comes down with exceptional force, or where it usually strikes the surface more constantly than at other points,—for instance, in narrow gullies. This appears to be the explanation of the cold water being found nearer the surface at those spots during strong winds in spring.

Mr. H. N. Dickson's recent discussion of the temperatures of the sea water, taken by herring fishers and others around the Scottish coasts, shows that colder water exists close to the shore at some seasons than at a distance out to sea. Off the Aberdeenshire coast it is believed that this state of matters can be directly connected with westerly winds blowing off the shore.

I am informed that it is the universal experience of bathers on the West Coast that the water is cold when the sea is calm or smooth, and very much warmer when it is rough, and in stormy weather. This has generally been ascribed hitherto to the thermo-dynamic heating of the water by the action of the waves, but there can be little doubt that it is due to the transference of the heated surface water to the lee shore by the wind. On the weather shore—that is, where the wind is blowing off the land—the sea is always smooth, while on an opposite shore, it may be only a mile or two distant, the sea may at the same time be very rough. Were it the custom to bathe only in the winter months, the very reverse of the above would be the universal experience. The warm water beneath would then be drawn to the surface on the weather shore, while all the cold surface water would be found along the shore towards which the wind was blowing: for instance, a man would have bathed in ice-cold water on the 14th December last, when the wind was blowing up Loch Striven, but five days later, when the wind was in the opposite direction, he would have bathed in water no less than 16° warmer.

Bearing of the Observations on Biological Phenomena.

Mr. Alexander Turbyne, who has had charge of the *Medusa* since she commenced these observations, is an experienced salmon-net fisher, and he informs me that whenever the wind is off shore, and the water consequently cold, the fishing is very poor. On the other hand, when the wind is on to the shore and the water warm, there are then the largest takes in the salmon nets; this he states is the experience of all the net fishers.

Our observations during the past few years seem, however, to indicate that there are very many creatures in the sea whose movements are more or less controlled by the wind—even some of those living at a considerable distance beneath the surface. Some of these may be briefly noted.

The dredgings and trawlings which have been made in the deepest water of these western lochs show some very remarkable peculiarities in distribution in the case of those animals which habitually live on, or are attached to, the bottom. Mr. W. E. Hoyle is preparing a report on these, which will be of much interest to naturalists. There are, however, a number of free-swimming and more or less pelagic animals met with at various depths in the waters of these lochs, which are restricted in their distribution in a way that we would not expect.

Judging from two years' observations, Loch Etive has a higher average temperature throughout the year than any other similar body of water in the country, and, as has been stated, it is more completely cut off from free communication with the ocean than any other of the sea lochs.

One small pelagic ostracod (*Conchœcia elegans*) is most abundant in this loch in all depths, from 10 fathoms under the surface to the bottom. At times, however, when strong winds are blowing, adult and larval specimens may be taken nearer the surface. It is a remarkable fact that not a single specimen of this or of any other pelagic ostracod has been taken in any of the other lochs, or around the coasts in more open situations, except in the Faroe Channel during the *Triton* and *Knight Errant* Expeditions,

when the tow-nets were sent down to and dragged in 200 to 400 fathoms.

Associated with this ostracod in Loch Etive is a large red copepod (*Euchæta norvegica*), which is never (or very rarely) taken off our shores, except when the nets are dragged many fathoms under the surface. This genus was unknown to British waters till these investigations were commenced a year or two ago. It exists in great abundance in Loch Etive, in Upper Loch Fyne, in Loch Goil, and in Loch Hourn; but only a few specimens have been captured in Lower Loch Fyne, Kilbrennan Sound, and other places in the Clyde sea-area. It appears to be wholly absent from some lochs, as Loch Striven, Gare Loch, Loch Aber, Loch Eil, and Loch Duich. In the Faroe Channel this species was also taken in 200 and 400 fathoms.

Two schizopodous crustaceans (*Nyctiphanes norvegica* and *Boreophausia Raschii*) are also found abundantly in the same depths as the two species above mentioned. The adults are usually taken in greatest abundance close to the bottom. The former are fully two inches in length, and both are provided with a series of phosphorescent organs, which give forth a brilliant emerald light in the dark. These animals are pretty widely distributed throughout the lochs, and in some of them are present in great numbers, although their existence was almost unknown a year or two ago. In some lochs, however, they are quite absent so far as our observations go—for instance, in Loch Etive, Loch Aber, Loch Eil, and Gare Loch, and only one of the species has up to the present time been found in Loch Duich. The adults and larvæ of these animals constitute a very large part of the food of the herring within the Clyde sea-area, and on some other parts of the coast. In the winter months we have taken many herring with their stomachs crammed with the adults. The herrings then feed on them, as a general rule, in deep water, over 30 fathoms and more beneath the surface. In certain states of the tide, and during strong winds, however, these animals, called *Sildhu* by the fishermen are brought to the surface in "spots," and the herrings follow them. It is in such circumstances that large takes of herring are made by the Campbeltown and other fishermen in winter. When the stomachs of herring are filled with food they are called "poke guts." When the food that fills the stomach consists of adult *Nyctiphanes* the herring is usually good for market; but when the stomach is filled with the larvæ of these animals or with copepods, then the contents undergo much more rapid decomposition, and the fish are soon from that cause alone rendered unfit for market.

The herrings, both adult and young, have been found throughout the Clyde sea-area at all times of the year both at the surface and in deep water, and there seems good reason for believing that, at all events, a very large number never migrate to the open sea. Throughout the whole of this area there is plenty of food at all times of the year, but in the winter this is generally captured within a few fathoms from the bottom.

In addition to the crustaceous animals above mentioned there are numerous macrurous crustaceans of much larger size, which never appear to rise above a few feet from the bottom. Some of these have a deep-red colour and others a transparent and glassy appearance—quite like in

their general aspect to those which the *Challenger* dredged from very deep water in all parts of the world. Some of them are present in great numbers, and were hitherto unknown in our waters, or were considered exceedingly rare. Such are *Pasiphœa sivado*, *Crangon echinatus*, *Crangon Allmani*, *Calocaris Macandreæ*, *Pandalus annulicornis*, *Hyppolyte securifrons*, etc. Some of these species are abundant in one, and quite absent in adjoining, lochs.

These species and other closely allied forms are also found in the deep water beyond the 100-fathom line all round our coasts. Their food consists of the minute particles of organic matter which is settling to the bottom just beyond the limits of wave and current action. The depth at which fine mud commences to form around our shores varies greatly according to position, but it appears to me that just at and beyond this line are situated the great and most constant feeding grounds of the salmon and herring, whether in our enclosed lochs or along our exposed Atlantic seaboard.

Our observations also appear to show that, when, after the winter solstice, the sun commences to move northward, there is with the first increase of sunshine and warming of the surface waters, an immense development of diatoms and other pelagic algæ at the immediate surface of the sea. Between the end of January and the first of May there were during the past two seasons immense floating banks of these in the enclosed and outside waters around our coasts. At first these banks were close to the surface, and the tow-nets were crammed with slimy gatherings composed of myriads of these organisms. As the season advanced these banks sank deeper, and spread out through the whole mass of water. These algæ form the primary source of food for the vast majority of pelagic and free-swimming animals, and of the animals living at the bottom of the ocean.

Coincident with this appearance of diatoms there is the occurrence of vast numbers of crustacean, fish, and other eggs in the surface and sub-surface waters. The larvæ of these animals either feed directly on these algæ or on copepods, schizopods, and other creatures which in turn depend on the diatoms for nourishment. It is thus more than probable that the development of the larval and post-larval stages of food fishes, in great abundance during any season, may be largely dependent on the quantity of sunlight; and that the migrations of fish from the open sea towards shores, and from deep water to the surface, may also be connected, in a large degree, with the appearance of algæ, and the development of minute larvæ which feed on them.

The observations here reviewed show how important it would be to make a detailed examination of our western lochs in their physical and biological relations, especially if these were undertaken in connection with an examination of the outer slopes of the Atlantic coast; such an investigation could not fail to supply almost every science with new and highly interesting data. The distribution of the animals above referred to indicate that these Scottish lochs were at one time connected by deeper water with the Atlantic, and that many of the animals were shut up in these enclosed lochs by the gradual elevation of the land, though it is more difficult to say how some species have been able to live on in some of

these lochs and not in others. To undertake researches on the scale here suggested is quite beyond private means, and in an age that looks with distrust on all work that does not promise some immediate and useful results, it is unlikely to be initiated by Government, for it is impossible to show beforehand that such researches would serve any direct practical utility or would directly benefit the fishing or any other industry. While this is the case, there are many, however, whose opinion is worth consideration, who believe researches like these—the acquisition of new knowledge of natural things—to be the highest duty of the State, and to be indicative of a wise and progressive people.

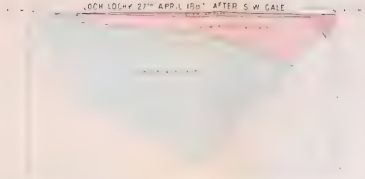
A thorough knowledge of the physical and biological conditions of our coasts and lochs might, at least, tend to prevent pernicious and foolish legislation. It appears to be seriously proposed at the present time to stop all beam trawling around our coasts within the three-mile limit, and notice has been given that it is proposed to close the Clyde sea-area for this method of fishing during the present summer.

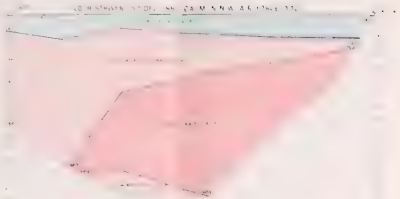
It is doubtless the duty of the State to organise a sufficient police within territorial waters, and to prevent conflict between line-fishers and beam-trawlers: it may even be a wise thing to prevent certain kinds of fishing altogether, but surely if huge experiments of this kind are to be performed at the expense of an industrious portion of the population, it should be with some definite end in view, and with the hope of arriving at some intelligible results. If these waters are to be freed from all beam-trawlers for a space of five, ten, or twenty years, by what means is it to be proved that the fish have increased or decreased during these periods? If it can be shown that they have increased, is that to be attributed to the stoppage of trawling? If it can be shown that they have decreased within the same period, is that likewise to be assigned to the same cause? These are questions to which no reasonable answers are likely to be forthcoming.

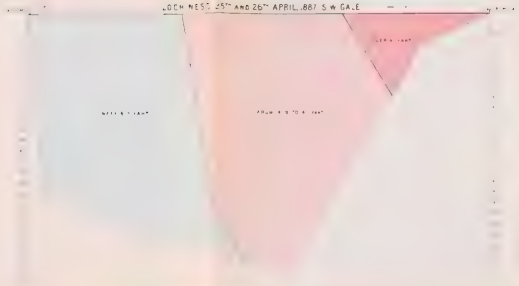
Within the Clyde area there are a considerable number of small vessels owned and worked by as industrious and intelligent a set of men as it has ever been my fortune to meet with among seafaring people. Some of them have, I am informed, been engaged in trawling in certain reaches around the Cumbraes, Bute, and off the Tail of the Bank for forty years. All their capital is invested in their boats and nets: it is useless to tell them to go to the outer waters, their boats and gear are suitable only for the waters in which they have been accustomed to work. I know something about this district, especially that portion of it to the north of Arran within which these men have been accustomed to ply their calling. There are not any line-fishers who object to the work of these trawlers, so far as can be ascertained, and it is not known that they are doing any serious harm to the fishings of the region.

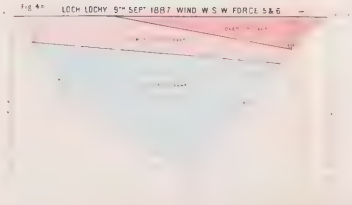
These men, who have supplied the markets with good and wholesome food for years, and have been able to support their families by a laborious and honourable occupation, are all at once to be thrown out of work, without compensation, because it pleases the State to make an idle experiment. It would be a wise thing to publish a plain statement of the reasons which justify these proceedings. I believe it correct to say that these cannot be based on any available scientific evidence.

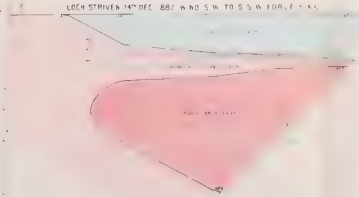
Diagrams illustrating the effect of Winds on the Distribution of Temperature in the Lochs of the West of Scotland











I.—LOCH LOCHY.

Date, . .	April 27.	April 27.	April 27.	April 27.	April 27.
Position,	Outside Laggan Lock.	1 mile from Laggan Lock.	1¼ miles from Laggan Lock.	Off Glastard.	Off Ochnacar.
Time, . .	10.20.	—	10.37.	11.15.	12.0.
Wind, Force	SW. 1.	SW. 1.		SW. 1.	NW. 1.
Wr. & Sea	Bright.	Bright.	—	Bright.	Bright.
Depth, .	8 Fms.	15 Fms.	—	74 Fms.	41 Fms.
Tem. of Air	39·6	—	—	41·2	—
Fathoms					
0	44·0	43·1	43·1	43·2	43·0
1	...	...	...	...	...
2	...	...	42·7	...	...
3	43·9	...	...	...	...
4	...	42·8	...	..	...
5	44·0	...	...	42·4	42·3
6	...	...	...	...	...
7	43·9	...	...	...	...
8	...	...	...	...	...
9	...	...	...	...	42·3
10	...	...	...	42·4	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	...
14	...	42·7	42·5	...	...
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
22	...	...	42·5	42·1	42·2
24	...	...	...	...	...
26	...	...	...	...	...
28	...	...	...	...	...
30	...	...	...	42·1	42·2
40	...	...	...	42·0	42·2
50	...	...	...	...	...
53	...	...	...	41·9	...
63	...	...	...	41·9	...
73	...	...	...	41·7	...

II.—LOCH NESS.

Date, . .	April 25.	April 25.	April 25.	April 25.	April 26.
Position,	1 mile from Fort Augustus.	Off Port Clair.	Off Foyers.	Urquhart Castle. NE. 1 m.	Off Aldourie.
Time, . .	14.0.	15.20.	16.40.	17.40.	9.0.
Wind, Force	SW. 8.	SW. 8.	SW. 9.	SW. 8-10.	0.
Weather and Sea	Snow. Rough.	Snow. Rough.	Rough. Showers (hail).	Hail. Rough.	Dull. Snow.
Depth, .	85 Fms.	103 Fms.	112 Fms.	126 Fms.	15 Fms.
Tem. of Air	41·3	41·8	40·0	38·5	36·8
Fathoms.					
0	41·6	41·8	41·9	41·9	42·9
1	41·4	41·7	42·0	42·0	43·0
2	...	...	...	...	...
3	...	...	42·1	...	...
4	...	41·7	...	...	42·9
5	41·4	...	...	42·1	...
6	...	...	41·9	...	...
7	...	...	...	...	43·0
8	...	...	42·0	...	...
9	...	...	...	...	43·0
10	41·5	41·8	41·9	41·9	...
11	...	...	41·9	...	...
12	...	...	42·0	...	...
13	...	...	...	...	...
14	...	...	41·9	...	43·0
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	41·9	...	...
20	41·5	41·8	41·8	42·0	...
22	...	...	...	...	...
24	...	...	...	...	...
26	...	...	...	..	...
28	...	...	...	...	...
30	41·6	41·8	...	42·0	...
40	41·4	41·8	...	41·9	...
50	41·5	41·8	...	42·0	...
60	...	41·8	...	42·0	...
64	...	41·8	...	...	...
70	...	...	...	41·9	...
74	41·4	...	...	...	...
79	41·4	...	...	...	...
80	...	...	...	...	...
84	41·4	41·7	...	...	...
90	...	...	...	41·9	...
102	...	41·4	...	...	...
105	...	...	...	41·9	...
111	...	...	41·8	...	...
125	...	...	...	42·1	...

III.—LOCH NESS.

Date, . .	Sept. 8.	Sept. 8.	Sept. 8.	Sept. 8.	Sept. 8.	Sept. 8.	Sept. 8.	Sept. 8.
Position,	Off Aldourie.	Off Aberiachan.	Off Castle Urquhart.	Off Foyers.	Off Inver-morriston.	1 mile from Fort Augustus.	Off Monas-tery, Fort Augustus.	Off Monastery.
Time, . .	11.10 a.m.	11.50 a.m.	1 p.m.	3.15 p.m.	4.25 p.m.	5·15 p.m.	6 p.m.	8.10 a.m.
Wind, Force	WSW. 5.	WSW. 5.	WSW. 5.	WSW. 6.	WSW. 4.	WSW. 5.	WSW. 5.	W. 3.
Weather & Sea,	Overcast, Very Rough	Overcast, Very Rough.	Cloudy, Rough.	Overcast, Very Rough	Overcast, Rough.	Rain, Rough.	Rain. Rough.	Overcast, Roughish.
Depth, .	15 fms.	70 fms.	121 fms.	109 fms.	101 fms.	80 fms.	42 fms.	42 fms.
Tem. of Air,	56·5	—	57·1	—	—	—	—	53·5
Fathoms.								
0	53·9	54·0	54·1	54·5	54·1	51·5	47·8	44·9
1	...	...	54·0	...	. .	...	...	54·9
2	53·6	...	53·7	...	...	...	57·1	...
3	...	...	...	...	...	...	...	...
4	53·8	...	...	...	...	...	...	...
5	...	53·9	53·8	...	...	48·0	47·0	54·5
6	...	...	...	...	...	...	...	44·4
7	53·7	...	...	...	...	...	...	...
8	...	...	...	...	...	...	46·7	44·6
9	53·5	...	...	...	...	...	...	...
10	...	54·0	...	54·3	52·3	46·6	46·1	...
12	...	...	...	...	...	...	...	...
14	53·5	...	53·7*	...	...	45·7*	45·3*	47·4*
16	...	...	...	...	...	..	...	...
18	...	...	...	...	..	...	..	...
20	...	54·0	50·2	51·7	44·7	44·5	45·1	46·5*
22	...	...	...	...	...	...	...	...
24	..	...	49·7*	...	...	44·1*	...	...
26	...	...	...	...	...	...	...	45·2
28	...	...	...	46·8	...	...	...	...
30	...	53·0	48·5	...	43·4	43·8	23·6*	..
32	...	...	...	...	...	...	...	...
34	. .	...	48·3*	...	...	...	...	...
36	...	...	...	...	...	...	...	...
38	...	...	48·0	...	...	...	...	...
40	...	47·9	45·8	...	...	43·3	...	44·8*
42	...	...	...	..	...	...	...	...
44	...	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...	...
48	...	44·0*	...	...	...	...	...	...
50	...	...	44·3	...	...	43·0	43·2*	...
52	...	...	...	...	...	...	...	...
54	...	...	...	. .	...	...	...	...
56	...	...	...	...	...	...	...	...
58	...	53·3*	...	...	...	42·8*	..	...
60	...	...	43·6	. .	42·9	...	...	...
62	...	...	...	...	...	...	...	...
64	...	...	...	...	...	...	...	...
66	...	...	...	...	...	...	...	...
68	...	53·1*	..	...	...	42·7*	...	...
70	...	...	43·0	...	...	...	...	...
72	...	...	...	...	...	...	...	...
74	...	...	...	...	...	...	...	...
76	...	...	...	...	...	...	...	...
78	...	...	...	...	...	42·7*	...	...
80	...	...	43·0	...	...	...	...	...
82	...	...	...	...	...	...	...	...
84	...	...	...	...	...	...	...	...
86	...	...	...	...	...	...	...	...
88	...	...	...	...	...	...	...	...
90	...	...	42·7	...	...	...	...	...
92	...	...	...	...	...	...	...	...
94	...	...	...	...	...	. .	...	...
96	...	...	...	...	...	...	...	...
98	...	...	...	...	...	...	...	...
100	...	...	42 6	...	42·5	...	...	...
102	...	...	...	...	...	...	...	...
104	...	...	...	...	...	...	...	...
106	...	...	...	...	...	...	...	...
108	...	...	...	...	...	...	...	...
110	...	...	42·5	...	...	...	...	...
112	...	...	...	...	...	...	...	...
120	...	...	42·2	...	...	...	...	...

* Observations made one fathom deeper than indicated.

IV.—LOCH LOCHY.

Date,	Sept. 7.	Sept. 7.	Sept. 7.	Sept. 9.	Sept. 9.
Position,	1 mile from Locks.	Off Glastar.	Off Achnacarry.	1 mile from Laggan Locks.	Off Auchnacarry.
Time,	2.50	1.50 p.m.	12.45 p.m.	11.15.	12.35.
Wind, Force,	Calm.	NE. 1.	NE. 2.	WSW. 6.	WSW. 5.
Weather and Sea,	Calm, Smooth.	Bright, Smooth.	Fine, Smooth.	Rain, very Rough.	Rain, Rough.
Depth,	15 fms.	76 fms.	37 fms.	12 fms.	38 fms.
Tem. of Air,	55·7	54·8	55·0	—	—
Fathoms.					
0	54·7	56·0	56·6	55·2	54·9
1	54·4	56·0	...	55·2	...
2	54·8	55·3	56·1	...	54·7
3	54·6	...	...	...	...
4	54·5	...	...	...	...
5	54·3	55·7	56·1	55·1	54·8
6	...	...	...	55·1	...
7	54·1	...	56·0	...	...
8	...	...	...	...	54·1
9	...	...	...	...	...
10	53·7	55·3	56·2	55·1	52·7
12	53·5	...	...	...	...
14	...	...	...	...	49·9*
16	...	54·9	55·4	...	49·3
18	...	...	53·0	...	...
20	...	47·1	47·2	...	48·2
22	...	...	...	...	...
24	...	46·7*	45·8	...	...
26	...	...	45·1	...	46·5
28	...	...	...	...	...
30	...	45·2	44·9*	...	45·1*
32	...	...	...	...	...
34	...	44·7*	...	...	...
36	...	...	...	...	44·3*
38	...	...	...	...	...
40	...	44·8	...	...	...
42	...	...	...	...	...
44	...	...	...	...	...
46	...	...	...	...	...
48	...	...	...	...	...
50	...	44·1	44·1	...	...
52	...	...	...	...	...
54	...	53·8*	...	...	...
56	...	...	...	...	...
58	...	...	...	...	...
60	...	...	...	...	...
62	...	...	...	...	...
64	...	44·0*	...	...	...
66	...	...	...	...	...
68	...	...	...	...	...
70	...	...	...	...	...
72	...	...	...	...	...
74	...	53·7*	...	...	...

* Observations made one fathom deeper than indicated.

V.—LOCH STRIVEN.

Date, . .	14th Dec. 1887.	14th Dec. 1887.	14th Dec. 1887.	14th Dec. 1887.	14th Dec. 1887.
Position,	Head of Loch.	Off Artarig Hills.	Off Clapochlar Point.	Off Strome Point.	Off Port Lamont.
Time, . .	12.30.	12.0 p.m.	1.0 p.m.	2.10 p.m.	4.0 p.m.
Wind, Force	SW. 5.	SW. 6.	SW. 6.	SSW. 6.	SW. 6.
Weather & Sea,	Cloudy, Overcast, Roughish.	Cloudy, Overcast, Rough.	Overcast, Rain, Rough.	Overcast, Rain, Rough.	Overcast, Rain, Rough.
Depth, .	—	24 Fms.	35 Fms.	36 Fms.	29 Fms.
Barometer	28·83.	28·81.	28·80.	28·80.	28·75.
Tem. of Air,	—	—	—	—	—
Fathoms.					
0	39·3	43·3	43·7	44·0	45·0
1	42·0	...	43·8	...	...
2	...	...	...	44·1	45·1
3	42·9	...	43·6	...	...
4	...	43·3	...	44·3	...
5	42·9	43·3	45·3	44·3	46·4
6	...	43·3	...	45·6	..
7	...	43·8	44·2	...	...
8	44·0	47·9	48·0	47·9	48·0
9	...	48·2	...	...	...
10	49·0	48·5	48·2	48·0	...
11	49·0	48·8	...	...	...
12	...	...	...	...	...
13	...	48·7	...	...	...
14	...	...	48·9	...	...
15	...	...	...	49·0	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	48·3
19	...	...	...	...	...
20	...	...	49·1	49·0	...
22	...	48·9	...	...	...
24	...	...	49·0	48·2	...
26	...	...	...	...	...
28	...	...	...	...	48·4
30	...	...	48·9	48·3	...
32	...	...	...	...	...
34	...	...	48·3	48·3	...
36	...	...	...	...	...

VI.—LOCH STRIVEN.

Date,	15th Dec. 1887.	15th Dec. 1887.	15th Dec. 1887.	15th Dec. 1887.	15th Dec. 1887.	15th Dec. 1887.
Position,	Head of Loch.	Off Artarig Hills.	Off Clapochlar Point.	Off Strome Point.	Off Port Lamont.	Between Rothesay and Ardlui Bay, Toward Shore.
Time.	12.30 a.m.	11.40 a.m.	10.53 a.m.	9.45 a.m.	9.20 a.m.	8.50 a.m.
Wind & Force,	Calm.	Calm, or NNW. air. Calm.	Calm.	NNW. air. 1.	NNW. air. 1.	Calm. NNW. air. 0
Weather & Sea.	Cloudy, Fine; Smooth, (covered with ice about 1-16 in. thick).	Sunshine, Smooth.	Sunshine, Smooth.	Bright sunshine, Smooth.	Clear, bright, Smooth.	Sky clear, Smooth.
Depth,	13 Fms.	23 Fms.	35 Fms.	35 Fms.	29 Fms.	22 Fms.
Barometer,	29·07.	29·07.	29·05.	29·00	28·97.	28·95.
Tem. of Air,	—	—	—	—	—	—
Fathoms.						
0	42·5	41·3	42·0	43·5	43·8	44·7
1	43·1	43·0	43·4	...	...	44·8
2	43·1	43·2	...	44·4	44·7	...
3	43·1	43·4	43·8	...	...	...
4	43·2	43·9	...	46·3	...	...
5	48·0	47·4	47·1	46·3	...	45·7
6	48·1	48·0	...	46·7	46·1	...
7	48·5	...	48·1	...	...	...
8	...	48·3	48·1	47·1	47·0	...
9	...	...	...	...	...	...
10	48·6	48·6	48·3	47·7	...	...
11	48·8	...	...	...	...	46·8
12	...	48·9	...	...	...	...
13	...	...	...	...	...	...
14	...	...	48·9	...	...	...
15	...	...	...	48·5	...	47·4
16	...	...	...	...	...	...
17	...	49·0	...	...	...	...
18	...	...	...	...	48·2	...
19	...	...	...	...	...	...
20	...	...	49·0	49·1	...	48·0
22	...	49·0	...	...	...	...
24	...	...	49·0	...	...	...
26	...	...	...	48·9	...	...
28	...	...	...	...	48·4	...
30	...	...	48·9	...	...	...
32	...	...	...	...	...	...
34	...	...	48·6	...	...	...
36	...	...	...	...	...	...

VII.—LOCH STRIVEN.

Date, . .	19th Dec. 1887.	19th Dec. 1887.	19th Dec. 1887.	19th Dec. 1887.	19th Dec. 1887.	19th Dec. 1887.
Position,	Head of Loch.	Off Artarig Hills.	Off Clapochlar Point.	Off Strome Point.	Off Port Lamont.	Midway between Rothesay and Ardlui Bay.
Time, . .	9.20 a.m.	9.50 a.m.	10.45 a.m.	12.5 p.m.	1.10 p.m.	2 p.m.
Wind, Force	NNE. 1.	NNE. 2.	NNE. 2.	NNE. 2.	N. 2.	N. by W. 1.
Weather & Sea,	Bright, Smooth.	Bright, Smooth	Bright.	Bright, Cloudy, Smooth.	Bright, Roughish.	Bright, Smooth.
Depth, .	11 Fms.	22 Fms. (l. w.)	34 Fms.	36 Fms.	29 Fms.	24 Fms
Barometer	—	—	—	—	—	—
Tem. of Air,	—	—	—	—	—	–
Fathoms.						
0	47·8	46·6	45·5	44·9	44·0	43·7
1	48·0	46·2	45·6	45·1	...	43·8
2	48·1	46·5	...	45·2	45·3	44·4
3	48·2	46·6	45·7	...	45·3	45·1
4	48·2	...	46·3	46·3	45·3	...
5	48·3	47·0	46·5	46·5	45·4	45·3
6	...	..	...	46·7	...	...
7	48·4	46·9	46·7	47·3	45·2	45·9
8	...	...	...	...	...	...
9	48·4	...	47·1	...	46·1	...
10	48·4	47·1	47·3	47·5	46·4	46·9
11	...	...	...	47·6	...	...
12	...	47·2	47·7	...	47·6	47·3
13	...	...	47·9	...	...	47·5
14	...	47·2	47·9	...	47·6	...
15	...	...	48·1	47·9	47·6	...
16	...	47·4	...	...	...	...
17	...	48·1	48·4	...	...	...
18	...	48·3	...	...	48·0	47·8
19	...	48·3	...	...	...	...
20	...	48·6	48·7	48·4	...	...
22	...	48·7*	48·8*	...	48·2*	47·5*
24	...	...	...	48·9*	...	...
26	...	...	...	48·9	47·7	..
28	...	...	...	...	47·4	...
30	...	...	48·6	48·4	...	...
32	...	...	48·6	...	...	...
34	...	...	...	48·4	...	...
36	...	...	...	...	...	...

* Observation made one fathom deeper than indicated.

VIII.—LOCH FYNE.

Date,	4th Jan. 1888.	4th Jan. 1888.	4th Jan. 1888.	4th Jan. 1888.	4th Jan. 1888.
Position,	Inveraray Anchorage.	Off Strachur (at Anchor).	Same as last.	Inveraray Pier.	Inveraray Pier.
Time,	9.45 a.m.	12 noon.	3.45 p.m.	5.0 p.m.	7.55 p.m.
Wind & Force,	SSW. 2.	S. Gale 7-8 in gusts	S. Gale 7-8.	S. Gale.	S. Gale.
Weather and Sea,	Rain, Roughish.	Rain, Rough.	Rain, Rough.	Rain, Rough.	Showers, Rain, Rough.
Depth,	6 Fms.	8 Fms.	8 Fms.	—	—
Barometer,	—	—	—	29·5	—
Temp. of Air,	—	49·0.	47·0 (wet).	—	—
Fathoms.					
0	43·7	47·4	47·4	42·0	41·2
1	45·8	47·3	...	...	...
2	46·9	47·3	..	..	...
3	...	47·3	47·3	...	...
4	46·3	...	...	...	...
5	46·4	47·3	...	...	...
6	46·9	...	47·3	...	...
7	...	47·3	...	...	...
8	...	...	...	...	...
9	...	...	...	...	...
10	...	...	...	...	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	..
14	...	...	...	...	...
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
22	...	...	...	...	...
24	...	...	...	...	...
26	...	...	...	...	...
28	...	...	...	...	...
30	...	...	...	...	...
32	...	...	...	...	...
34	...	...	...	...	...
36	...	...	...	...	...
38	...	...	...	...	...
40	...	...	...	...	...
42	...	...	...	...	...
44	...	...	...	...	...
46	...	...	...	...	...
48	...	...	...	...	...
50	...	...	...	...	...
52	...	...	...	...	...
54	...	...	...	...	...
56	...	...	...	...	...
58	...	...	...	...	...
60	...	...	...	...	...
62	...	...	...	...	...
64	...	...	...	...	...
66	...	...	...	...	...
68	...	...	...	...	...
70	...	...	...	...	...
72	...	...	...	...	...
74	...	...	...	...	...
76	...	...	...	...	...
78	...	...	...	...	...
80	...	...	...	...	...

LOCH FYNE—*continued.*

Date,	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.	5th Jan. 1888.
Position,	Close to Inveraray Pier.	Anchorage, Inveraray.	Off Inveraray.	Off Dundrave.	Off Cuil, Hd. of Loch.	Off Strachur.	Off Strachur Shore.	Off Penmoor Point.
Time,	1 p.m.	1.30 p.m.	1.50 p.m.	2.45 p.m.	3.30 p.m.	4.30 p.m.	5.5 p.m.	5.20 p.m.
Wind, Force,	Calm.	0.	0.	0.	SSW. 1.	NW. 1.	NW. 2.	NW. 2.
Weather & Sea,	—	Overcast, Smooth.	Overcast (rain), Smooth.	Overcast (rain), Smooth.	Rain, Smooth.	Clo'dy, Clear, Showers, Smooth.	Clear, Smooth, Rippled.	Clear, Cloudy, Smooth.
Depth,	—	8 Fms.	63 Fms.	37 Fms.	16 Fms.	76 Fms.	8 Fms.	—
Barometer,	—	—	29·18	29·2	29·25	29·3	—	—
Tem. of Air,	—	—	44·8	—	—	44·2	—	—
Fathoms.								
0	41·7	40·9	41·9	42·2	41·0	43·0	42·5	42·7
1	...	46·5	43·4 ‖	45·8	46·3	...	...	...
2	...	47·0	46·3 †	...	...	...	...	...
3	...	47·0	46·9	...	...	...	47·2	...
4	...	47·0	47·2	46·0	46·2	...	...	...
5	...	47·0	47·0	46·9	46·4	...	47·2	...
6	...	46·9	...	46·6	46·8	47·3	...	47·3
7	...	46·9	...	...	...	...	...	...
8	...	47·0	...	46·6	...	...	...	...
9	...	...	...	...	46·7	47·2	...	47·2
10	...	...	46·9	46·5	46·7	..	...	...
11	...	...	...	46·9	...	...	...	...
12	...	...	...	...	...	...	...	...
13	...	...	...	47·1	...	...	...	...
14	...	...	...	...	47·1	...	...	...
15	...	...	47·3	...	...	...	...	...
16	...	...	...	47·2	47·3	...	...	...
17	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...
20	...	...	47·3	...	...	47·2	...	...
22	...	...	...	...	...	...	...	...
24	...	...	47·3*	...	...	...	...	...
26	...	...	...	47·4	...	...	...	...
28	...	...	...	...	...	...	...	...
30	...	...	47·4	...	...	47·3	...	...
32	...	...	...	...	...	...	...	...
34	...	...	47·5*	...	...	...	...	...
36	...	...	...	47·6	...	...	...	...
38	...	...	...	...	...	...	...	...
40	...	...	...	...	...	47·3	...	...
42	...	...	46·9	...	...	...	...	...
44	...	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
52	...	...	47·0	...	...	...	...	...
54	...	...	...	...	...	47·2*	...	...
56	...	...	...	...	...	...	...	...
58	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
62	...	...	47·6	...	...	...	...	...
64	...	...	...	...	...	47·3	...	...
66	...	...	...	...	...	...	...	...
68	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
72	...	...	...	...	...	..	...	...
74	...	...	...	...	...	47·1*	...	...
76	...	...	...	...	...	...	...	...
78	...	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...	...

* Observation made one fathom deeper than indicated.
† Observation made one fathom less deep than indicated.
‖ Observation made half fathom less deep than indicated.

THE UTILISATION OF WASTE LANDS.

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The great Land Question, in one or other of its varied aspects, is a subject in which all geographers may naturally be expected to take some interest. While the public eye is fixed on extensive schemes of State aided emigration, colonisation, and land-law reform, it may be well to regard the matter from another point of view, and turn aside for a little to consider whether, without the aid of red tape and Parliaments, it may not be possible to do something to improve the corner of the globe in which our lot is cast, and render it better fitted to support in comfort its present teeming population. Before a country can be said to be over-populated it must first be proved that no human ingenuity can further add to its productiveness. With the advance of civilisation come new discoveries, and new sources of wealth and subsistence are revealed, so that a country which would be vastly over-populated with a population of savages, might, with a race of intelligent inhabitants, maintain satisfactorily a population many times as numerous.

In the following paper, I propose to make some inquiry as to how far it may be possible to improve land in Scotland which is now to a greater or less degree waste—*i.e.* capable of being turned to better account, and made to support in comfort a larger population than it at present sustains. To treat such a subject adequately would, of course, entail far more skill and time than I possess, but these pages are penned in the hope that they may be of use in suggesting lines on which some of our national resources may be turned to better advantage, or at least husbanded and prevented from deteriorating at the present rate.

I am quite aware that to such an inquiry the objection may be raised, that it is at present worse than useless to talk of improving waste lands when land in the highest state of cultivation is of almost no agricultural value, except near towns, where a ready market can be obtained for farm produce. The practical farmer will say that the more waste land reclaimed, and the consequent greater production of cereals, the greater will be the competition in the market, and the lower the prices obtained. Were the population stationary this objection would no doubt be weighty, but it is not likely that emigration will exactly counterbalance the natural growth of the population for many years to come. The number of mouths to feed, and people to be housed and clad, will continue to grow, and a corresponding increase in the necessaries of life will always be demanded. At present the struggle between the home and the foreign producer is unequal, and will remain so to a greater or less degree until the natural equilibrium is restored, unfair tariffs are removed, and virgin soils become exhausted in foreign lands, and until the population in these countries increases to the point reached already by ours, when all the natural produce is required to support it. Such a condition of things may indeed be distant, but this paper is prospective, and the distance

may not be so great as may at first sight appear. A minimum of prices must sooner or later be reached, below which foreign produce cannot greatly affect our markets, and it seems probable that in some directions this point is nearly reached already. Last year, for the first time I believe, British potatoes were largely and profitably exported to America, in spite of the heavy tariff levied against them, and if we can hold our own even in one department under such unfavourable conditions, we may reasonably hope for a measure of prosperity when the combat becomes more equally matched. Foreign farmers must live as well as others, and it is well known that, acre for acre, the ground of the Lothians is, by skill and industry, capable of yielding a better return in cereals than that of most foreign countries. In spite of the doleful tales of the British agriculturist, I am inclined to take a more hopeful view of matters, and do not doubt that, by studying economy, and by improving the productiveness of the land just now, when prices and wages are low, and by making ready as much ground as possible, even if the immediate return for the capital expended be insignificant, we shall, some years hence, have reason to congratulate ourselves on our foresight.

A large rural population is a pillar of strength, moral as well as material, to every community, and anything that can be done to prevent the depopulation of our rural districts should be attempted, for

> "A bold peasantry, their country's pride,
> When once destroyed can never be supplied."

The aim of this paper is practical. Personally, I have some knowledge of the difficulties of successful farming, and also some little experience in the reclamation of waste lands, so that the reader may rest assured that the suggestions made are not mere theoretical proposals which cannot be carried out in practice.

Sterility of the soil may be due to various causes, many of which it is necessarily beyond the power of human ingenuity to control. Greenland, for instance, has, since it was first explored, been devastated by the advance of vast glaciers, and Iceland has been greatly depopulated by volcanic eruptions and a succession of stormy seasons. Among the causes of sterility which may to a greater or less degree be modified by man, we may consider in order the following:—

1. Human improvidence.
2. Poverty of soil.
3. Dense vegetation.
4. Slight submergence.
5. Drifting sand.
6. Want of soil.

Human Improvidence.—A much greater area of once fruitful land has been laid waste by the reckless hand of man than is often supposed. Many tracts of country have been depopulated by the ruthless destruction of forests in some parts of Europe, and much good pasture-ground is at present being ruined by the removal of the skin of turf in others.

The first of these causes of sterility has, no doubt, as we shall afterwards see, greatly conduced to the poverty of our own Highlands, but it is perhaps still more strikingly exhibited along the shores of the Mediterranean. Reclus states that the depopulation and decadence of Syria,

Greece, Asia Minor, and the northern coasts of Africa and Spain, may be traced to the axe of the woodman no less than to the sword of the conqueror. Between 1471 and 1776, the *vigneries* of the French Alps lost a third, a half, or even three-quarters of their cultivated ground, and the inhabitants disappeared in the same proportion. The Upper and Lower Alps, between 1836 and 1866, lost 25,000 inhabitants, or nearly one-tenth of their population, and all this has been caused by the destruction of the extensive forests that once clothed these regions.

Trees tend to conserve, regulate, and increase the rainfall, and where there is danger of drought they should be preserved with great care. The air is itself diathermous, and the sun's rays pass through it without raising its temperature. The heat in the atmosphere is retained, not by the air, but by the small proportion of water vapour it contains, and is derived principally from the earth, which reflects and radiates back what it received by direct radiation from the sun. If the surface of the earth be bare and dry, it will give off much more heat into the superincumbent stratum of air than if it be kept moist and cool by vegetation, and if the air be thus heated, condensation will be checked, and the rainfall will diminish. But there is a second evil attending the destruction of forests. Trees not only tend to increase the rainfall, but the existence of a robe of vegetation over the hills prevents the soil from being washed down into the valleys during floods. Palestine is now no longer a fair, fertile land, flowing with milk and honey. The hills were once carefully terraced, and the rainfall was collected and used for cultivation by the industrious inhabitants. But now all is changed. The rain which falls at certain seasons is allowed to rush down in torrents and wash the soil into the valleys. During the remainder of the season, after the rains have ceased, the land is, to a great extent, a dry, parched wilderness.

Such direful results are easily produced, but centuries of patient industry and toil are required if the curse of a few years' wanton destruction is to be removed.

We do not, however, require to go so far a-field to witness the results of man's improvidence. The inhabitants of some of our own northern counties are also sinners in this respect. At many places, the crofters peel off quantities of turf which has taken years to form, and use it to make roofs for houses and byres, and for litter for their cattle. A roof of divots is both bad and expensive, as it requires to be renewed about every year. In Shetland, divots are cut annually in large quantities from the outfield or "scatthalt," and are used partly for roofing, partly for fuel, and partly for mixing with manure in the byres, where the cows live all winter. In spring, the byres are cleaned out, and the mould—that has sometimes accumulated within to such a depth that the cows which went in by the door are obliged to come out through the roof—is spread over the ground in the immediate vicinity of the houses.

When the protecting skin of vegetable fibre is thus recklessly stripped off, not only is the growth of good pasture arrested for many years, but the soil below is so exposed that it is easily washed away by the rain, or in some cases removed in clouds of dust by the wind. The island of Papa Stour has thus become almost uninhabitable, as scarcely any soil

remains beyond the thin green border along the tops of the sea-cliffs. I have myself seen many tracts of fair pasture-land nearly ruined by this cruel flaying of Mother Earth. Another piece of reckless stupidity is to be observed at most places where peat is extensively used. The coat of grass or growing vegetation which covers the solid peat must be removed before the fuel can be reached. In removing this, care should be taken to lay the divots down regularly face upwards on the ground below the bank where the peat is cut, so that the vegetation on the lowered surface of the moss may soon grow again and afford pasture, or even a new supply of growing peat for future generations. Instead of this, the improvident native flings the divots down topsy-turvy, leaving his successors to find for themselves peat and pastures new, and the sole remains rough and barren for years, unfit for grazing, and a ready prey to the waste of the elements.

Poverty of Soil.—Good soil consists of a mixture of soluble and insoluble mineral substances, with a certain proportion of vegetable fibre or organic matter, and moisture. Wherever any of these constituents is greatly in excess of the normal proportion, the ground becomes unsuited for the healthy growth of plants, and wherever there is a notable poverty of an essential ingredient, the deficiency must be artificially removed before the ground can be brought into a productive condition. But this is not all. The mechanical admixture of the ingredients requires attention also. The soil must be both uniform and open, so that the air can find its way downwards and produce the needful chemical and physical changes below as well as at the surface.

In many moorland districts the water sinks a few inches down, and in so doing dissolves some of the iron present in all soils. On reaching the less porous subsoil it perhaps stagnates and deposits the iron in the form of a hard crust of pan or brown limonite—the hydrated peroxide of iron. This impervious crust must be broken up either by deep ploughing or trenching if the soil is to become agriculturally useful. By doing so the surface water is let off, and the roots of plants can penetrate to greater depths, and draw sustenance from the underlying earth.

In such a climate as ours, where the rainfall is considerable, drainage is nearly always absolutely necessary in the reclamation of waste lands. If the natural soil, as is usual, consists of stiff till, tightly packed together by the great ice-sheets of the glacial period, so that no air or water can penetrate far into it, the first thing is to increase its porosity by drainage. The advantage thus gained is threefold. In the first place, the surface water, instead of running off the slopes immediately after every shower, and washing away the skin of good soil that may have accumulated, sinks down, and, after passing through the ground, flows off quietly without removing much sediment. In the second place, it carries down air and carbonic acid, which warms up the ground and hastens the solution of minerals and the decomposition of organic substances. Carbonic acid dissolved in water is the great solvent of rocks. It is this gas that enables water to eat away great caverns in limestone, and to disintegrate the hardest cliffs of granite and whinstone. The oxygen of the atmo-

sphere, again, is the great rotting agency and source of combustion. The rotting of organic matter in the soil is really a very slow combustion, and, as such, is accompanied with the evolution of heat. Unless the organic matter rots, and returns to the soil the mineral matter it originally borrowed, it is of little value. In rotting, it is therefore improving the soil, both by heating and by feeding it, so that the more air that can obtain access the better. A third advantage of drainage is its checking of too much surface evaporation. When water evaporates, it absorbs a great deal of heat and cools everything round it, and if the soil be in a state of constant saturation its temperature can never rise, on account of the continued evaporation. A warm soil is one into which the surface water readily sinks, and a cold retentive soil is one which retains the water and prevents the entrance of the warm air from above.

The Earth is like the men that inhabit it; it requires air, water, food, and raiment, if it is to fulfil properly its place in nature, and do its share of the work of the universe.

Besides by drainage, there are other simple ways of improving poor soil. Lime was formerly used by the farmer in far larger quantities than at present, but it has now become greatly superseded by other kinds of light manure, and the kilns and quarries, so numerous in most limestone districts, are now nearly all deserted. Should lime ever come into fashion again, and the prices of agricultural produce enable the farmer to use it largely, it may be of interest to draw attention to the great limestone deposits of Durness and Eriboll in Sutherland. The Durness limestone is by far the thickest in Scotland, and is situated on the coast, so that, were there a good harbour, it might be cheaply shipped to all our northern maritime counties. The Eriboll limestone—an extension of the same rock—is quarried along the shores of Loch Eriboll a few miles east of Durness, where there is a small harbour, and an excellent roadstead for storm-stayed vessels. This limestone is inferior to the Carboniferous limestone of Ireland for agriculture, as the bed worked contains rather too much Magnesia. It gives, however, an excellent building lime, and there are beds to be found in which Dolomite or Carbonate of Magnesia is nearly absent. In that wild and barren corner of Britain, the presence of a limestone seam can be detected miles away by the hue of the vegetation around it, which flourishes green and bright in the midst of a bleak waste of brown bent and weird grey rock.

Potash is another very useful fertiliser, and is largely imported from abroad for agricultural purposes. Recent experiments have been made, at the experimental farm of the Highland and Agricultural Society, on the effect of ground felspar as a potash manure, and the results have been of considerable value. The felspars are a group of minerals with certain physical properties in common, and containing silicate of alumina, with lime, potash, or soda, but it is only the orthoclase or potash felspar that is of agricultural value. Orthoclase contains about 13 per cent. of potash, and can readily be ground up into fine powder. If exposed to weather it rapidly decomposes into pure clay, or kaolin and potash, which is carried off in solution. In some parts of our poverty-stricken north-west Highland districts, the country consists of naked tracts of gneiss traversed

by multitudes of veins of pegmatite, a kind of very coarse granite largely made up of orthoclase felspar. It might be worth considering, in districts where there is much pegmatite, and water-power for grinding, whether the felspar could not be quarried, ground, and sent south at a sufficiently remunerative price to give work to some of the unemployed crofters, and save the Lowland farmers from going to foreign markets for all their potash manure.

According to Darwin, earth-worms are important fertilisers of the soil. They help to mix it up, and bring the subsoil to the top. They are also, no doubt, useful in increasing the porosity and circulation of air through the soil. In giving a field a "rest" by laying it down for several years in grass, the farmer is simply letting the worms have peace to go on with their deep trenching operations, and replace the exhausted surface skin with material from below, containing more of the needful mineral constituent. Earth-worms should thus be befriended, and their enemies the moles exterminated. New varieties of earth-worms, with greater burrowing and trenching capacity than the old residenters, might, even in the distant future, be introduced! It is hard to say what natural agencies may not one day be turned to good account when scientific farming comes to be better developed.

In many districts the soil is poor from having too much sand and gravel, and too little argillaceous matter. Light soils of this class are not suited for such crops as wheat and beans, which flourish best on stiff clay ground. To improve such districts requires a great deal of patient work, and, even when reclaimed, much of the light soil of the north is of but little value. If clay or marl is to be found in the neighbourhood, it may be spread over the surface year by year, and in course of time a fair sole of earth may accumulate, on which oats and potatoes can be grown to advantage. Where, however, the soil is very gravelly, clay is usually not to be had in any quantity, and very little can be done in the way of improving the ground beyond burning off the heather and letting fresh grass spring up for pasture.

Such ground may sometimes be planted with hardy forest trees, which can be cut and sold periodically. The great plain of moraine heaps and gravel mounds along the Spey, near Grantown, is thus utilised. The ancient forest of Rothiemurchus flourishes on a barren, sandy desert of detritus left by the old glaciers which once devastated Strathspey. The wood is principally Scots fir, and was formerly cut and floated down the Spey, while young trees were planted to take the place of those removed. Extensive planting is still carried on in that district, and ground otherwise almost useless is made to rear a slow-growing crop, whose value, if not great, is at least appreciable.

The difficulties that beset the afforesting of the Highlands are, however, formidable. The inaccessibility of most districts, and the impossibility of a cheap and easy transit for the felled trunks to the markets, renders their speedy disposal difficult. Another objection of a scarcely less important order lies in the consideration that he who plants will probably never live to reap. A good trunk takes about eighty years, or over two generations, to reach maturity, so that unless a proprietor's

father or grandfather had begun the work of planting, he himself would be simply investing, for the benefit of his successors, capital which would yield no interest for many years. From this point of view, the afforesting of large areas by Government might be a practical way of rendering State aid to the Highlands. In planting large areas and thinning out the weaklings periodically, to let the stronger trees grow properly, constant employment would be given to a certain number of the inhabitants. As the saplings sprung up, good cover for game would be formed, and, on thinning out the young trees at a further stage of their growth, there might be a sufficient quantity of grass for some grazing. Grass below trees, it is true, is not so well liked by cattle, and is less nourishing, from the deficiency of sunlight, than grass grown in the open; but, failing other pasture, it is always of some value, and the shelter of trees is useful for wintering stock as well.

In coal-mining, enormous quantities of "trees," or short pieces of pine stems, are used to support temporarily the roofs of the seams where the miners are at work. To keep our railways in repair also, some 8000 acres of wood require to be felled annually. This timber is nearly all cut in Norway and Sweden, and brought over cheaply to our eastern seaports. One reason why native timber is so little used is, I believe, its inferior durability and greater liability to decay than foreign wood. If home-grown timber is to come into use in coal-mining, new and better species of pine must be introduced, which will produce, in our temperate climate, wood of the requisite strength and durability.

But there is another aspect of the forest question that will sooner or later demand attention. If home-grown wood will not do for coal-mining, it may one day have to be used for coal itself. The quantity of Carboniferous fuel is limited, and at the present extravagant rate of consumption it will become gradually exhausted. When coal was first discovered, nothing but the outcrops of the seams were worked. Before the invention of the steam-engine, the difficulties in the way of pumping the water and hauling up the coal prevented deep mining. But now, seams can be worked to depths approaching 300 fathoms, with comparative ease. A large quantity of coal exists at still greater depths, but the increase of pressure, temperature, and other causes, renders very deep workings difficult and dangerous. As the upper parts of the seams become exhausted the price of coal will rise, and instead of exporting we shall have either to import foreign coal, or make use of some other source of heat to keep the pot boiling. Our comfortable open fires and cheery winter hearths will have to be improved off the face of the land, and the more economical close stoves will come into general use here as well as among our neighbours on the Continent. Foreign coal may be plentiful, as no doubt it is in Asia and America, but it cannot be transported for nothing, and political circumstances might arise which would raise it to famine prices. Had we a great reserve of natural fuel in the shape of forests to help us at a pinch, we should be much stronger in every way. Caledonia was once a land of "shaggy wood," and a great part of it might with advantage become so again. Trees will grow on almost absolutely barren rock, and there are vast tracts in the Highlands

well suited for extensive afforesting, where the soil is not only far too poor to be worth improving, but is almost non-existent. Such a scheme could not of course be carried out except by a strong Company or by the State, which could afford to expend capital for the benefit of future generations, and be content to wait long for a dividend to be declared. By beginning gradually to plant, and continuing the work steadily and systematically, the trees would be ready for cutting in a century or so, when the price of coal may have risen so high that wood, and peat perhaps also, can be cultivated at a profit to supersede it. We are living at present on our capital, and not on its interest. When the capital runs done our successors will have no reason to bless our foresight. The ultimate source of energy is the sun. In using coal we are using up in a few centuries the heat received from the sun during many millions of years. It is of course impossible for us in the present state of civilisation to be anything in this respect but fast-livers, but it is not impossible to try and do something to decrease our breakneck down-grade velocity, and so lengthen out the time of our race. In afforesting waste lands, and thus storing up as much of the sun's available energy as we can, we would have the satisfaction of feeling that we had taken at least one step in the right direction, and done more for our descendants than our ancestors have ever done for us.

Dense Vegetation.—Land may, however, be as valueless from too much as well as from too little vegetation. If the vegetation is of the wrong kind, or if there is an excess of one kind, it must be reduced till the happy medium is arrived at. In some countries the forests are so thick that they must be cleared before the ground attains its maximum of productiveness. The only kind of vegetation that requires to be extensively cleared away in this country is peat. In some cases the peat mosses cover up tracts of rich soil, and must be removed before it can be reached. Perhaps the best instance of this is to be found in the Carse lands of the Forth at Stirling. The great plain through which the river meanders before entering the estuary above Grangemouth, was once a flat, muddy foreshore covered with the rich alluvial sediment washed from the higher districts at a time when the sea rose over the land some 15 or 20 feet higher than it does now. After the last emergence of the land, this area became covered with vegetation.

At the time of the Roman invasion, here, as elsewhere, the country was probably thickly clothed with trees, among which the Caledonians found a safe retreat from the enemy. To subjugate the country it was thus necessary to attack the trees first, and this the Romans seem to have set themselves resolutely to do. After the trees were thrown down, the Carse lands became converted into an impassable morass, through which the circulation of water was interrupted, and peat began to grow luxuriantly over the soaking ground. When or how all the ancient forests of Caledonia were destroyed it is difficult to ascertain, but it is certain, from the marks of fire and tools on the tree stumps found below many peat mosses, that at a former period not a few of the Scottish forests were destroyed by the hand of man. An increasing humidity in

the climate was no doubt once instrumental in promoting the decay of the trees, and the growth of peat on their site, but there is no lack of historical evidence that, a century or two ago, before the development of coal-mining, extensive tracts of forest land were cleared by the old iron-smelters. When, for example, the Carron Ironworks were started in 1760, one of the most important questions to be settled was how or where to obtain supplies of wood to smelt the ironstone, and in the older and smaller ironworks this difficulty was overcome by removing the furnaces or bloomeries, when necessary, to places where forests were yet remaining, and fuel was plentiful. Had a law been enacted that young trees be planted to replace those removed, or that "mother trees" be left here and there to produce families of seedlings around them, we should have been much better off now. As it is, much ground which could and should be under forest is under peat and heather, and is consequently of comparatively little value.

To improve agriculturally the value of such waste ground, the peat covering must either be removed, drained, or top-dressed with soil or some other necessary mineral substance, such as marl—a mixture of lime and clay found abundantly in many wet districts. In some cases bog-lands have been reclaimed by removing the peat wholesale and getting rid of it in the quickest possible way. The great bogs of the Carse of Stirling alluded to above, were reclaimed by floating the peat away into the Forth and making no further use of it. This method was first introduced by Lord Kames, who owned part of the Carse. Canals were cut through the moss into which the streams flowing from the high ground to the Forth were directed. The peat was cut, and thrown into the canals, whose lower extremities were temporarily closed, so as to raise the level of the water. On removing the dams the water rushed out carrying its load of peats into the river. For many years the shores of the Firth were strewn with lumps of peat brought down by the river during the reclamation of the Blairdrummond, Kincardine, and Flanders Mosses, but now the reclamations are nearly at an end, and the tracts of what a century or so ago was an uninhabitable useless morass are now inhabited by hundreds of families who live by cultivating the reclaimed ground.

It is of course unusual to find such excellent soil below, and such an easy way of disposing of the moss. As a rule, the underlying soil is cold, stiff till, which prevents the water from escaping beneath and thus promotes the growth of the peat-plant, for whose existence abundance of moisture is necessary. Nor is it desirable thus to throw away so much peat, as it is not in general an altogether useless cumberer of the ground. Peat is scarcely ever dug in Scotland except for fuel, and experiments on its utilisation are usually intended to show how it can be best employed as a substitute for coal. But there is another and totally different use to which it may with advantage be put. At present we import large quantities of compressed dried peat from Holland and Germany and the coasts of the Baltic, which is used in increasing quantities as litter for stables, etc. In considering the best kind of bedding to use, the farmer must always ascertain the properties of the litter as a manure-

producer. Dried peat-litter makes a clean, comfortable, and healthy bed for horses and cattle, but there seems to be some doubt as to what its value as a constituent of farmyard manure may be. I have lately made some inquiries on the subject, and find that the quality of peat-litter manure is first-rate, and is especially useful where the soil is stiff. If well dried, the moss can absorb a very large quantity of moisture, and it often happens that much of the moisture and ammoniacal portion of farmyard manure runs away and is lost for lack of some good absorbent to suck it up. I think that we have here room for a new industry which might give employment to many of the poor crofters in the north. Indeed, the manufacture of peat-litter is at present being carried on with marked success in Ireland, where, of all parts of the British Isles, bogs are most abundant. A Lowland farm is known to me where the tenant sells his straw and uses peat from a neighbouring moss for litter, and if it is profitable to turn this neglected natural product to advantageous use in one case, it must be so in scores of others where the conditions are similar. It must be remembered, however, that all kinds of peat are not equally adapted to the manufacture of litter. It is only the light brown or red peat that can be so used. This is found at the top of the moss only. The dense, black peat that lies below makes the best fuel, so that each part of the moss has its own special use. In making peat-litter the peat must be beetled or torn to small pieces by machinery and thoroughly dried in the sun, or, where the climate is too wet, under cover.

The manufacture does not require much skilled labour, as it can be carried out by whole families living near a moss, at a comparatively small expense. When it pays to buy foreign peat-litter at thirty-five shillings per ton, it is surely not too much to hope that this industry may at no distant date be introduced into our own country, where new sources of useful work are so much required.

Another source of employment connected with peat-bogs has recently been discovered in several parts of Scotland. Below many peat-mosses there is a deposit of diatomite, known also as infusorial earth and tripoli powder, which is extensively used in the manufacture of dynamite and various other arts. It is nearly white in colour, impalpable to the touch and is composed of microscopic rods of silica—the frustules of a very low type of plants that grew in the water before the peat began to flourish. The purest diatomite deposits yet discovered are found on the estate of Kilmuir in Skye, but others occur in Aberdeenshire and elsewhere, and I have no doubt that, were a careful search made, many other localities might be found to contain it in large quantities. In searching for diatomite, the best places to examine are those where the peat-moss occupies a basin surrounded by rock and watered by springs or clear streams which bring in no sediment, the presence of which might so dilute the silicious deposit as to render it worthless.

Slight Submergence.—Land which is only slightly submerged, or which is submerged periodically by the tides, has often been reclaimed extensively, and there is still abundance of room for the exercise of ingenuity in this direction. At one time Scotland was dotted over with

multitudes of shallow lagoons occupying hollows in the superficial glacial deposits that cover most of the Lowlands. A large number of these have been drained. At Edinburgh, for instance, there was a loch at Holyrood, whose site was for many a day occupied by a morass. Another formed the Nor' Loch, a third extended over the site of the Meadows, and a fourth existed in the hollow, south of Morningside Asylum. The drainage and reclamation of these lakes has been a benefit both to the health of the inhabitants and the value of the land.

The greatest tracts of reclaimable land are, however, the shallow foreshores or "slob lands" situated along the edges of the estuaries covered periodically by the tides. It has been estimated that in Britain and Ireland these cover an area of not less than 1000 square miles. Reclamations of the foreshores of the Forth, Tay, and Clyde have been in progress since the beginning of the century. In some cases the returns have been profitable, and in others the works have been financially a failure. According to Mr. David Stevenson, whose valuable paper "On the Reclamation and Protection of Agricultural Land" is published in the *Transactions of the Highland and Agricultural Society*, vol. vi., 1874, three considerations must be borne in mind before reclamation of foreshore is begun :—

1. "That in order to secure success, the space to be reclaimed must be within the influence of water containing much alluvial matter, and not on the shores of an open, sandy estuary.
2. "That the spaces to be reclaimed should be allowed to receive the deposit left by the tide for as long a period as possible, and the water should not be entirely excluded until they have, by gradual accretion, attained the level, if possible, of high-water of ordinary spring-tides.
3. "That by properly conducted survey and observations the amount and fertilising properties of the deposit should be ascertained in order to determine—*first*, over how many years the process of reclamation is likely to extend; and, *second*, what may be the productive value of the soil deposited."

In reclaiming foreshores the sea may be either shut out at once by surrounding the area with an embankment, or the ground may be reclaimed gradually by forming low training-walls, and so directing the water that it will deposit alluvial sediment at the sides of the main channel, and gradually raise the surface of the foreshore to nearly the level of high-water. In open, sandy foreshores, where the water is tolerably clear, the latter plan need not be attempted, and in such cases it is doubtful if profitable reclamation could even be accomplished. Within those estuaries, however, where the water is muddy—as, for instance, in the Firth of Forth above Queensferry—reclamation by "warping" might in some places be done very easily and cheaply. Between Bo'ness and Grangemouth, the retiring tide leaves bare a flat tract of sleech or "slob-land" some three or four square miles in area, a large part of which could be reclaimed with great ease. The proposal to embank and add this tract to the carse lands of Kinneil and Falkirk has

been made several times, but the scheme has always been frustrated by interested parties in the neighbourhood.

After shutting out the sea it is sometimes impossible at first to raise crops, on account of the saltness of the soil. In a few years, however, the salt disappears and vegetation begins to flourish. Between 700 and 800 acres were reclaimed from the sea at Brading Harbour, in the Isle of Wight, about eight years ago. For the first two seasons it was partly ploughed and harrowed to pulverise the soil, and, the second year after the sea had been excluded, it yielded good crops of oats and barley. Good average crops of beans, wheat, swedes, and mangold-wurzels were also produced, but during strong winds the fine soil was blown about in such clouds that it has been thought advisable to sow it down in grass and use it as pasture-land. Last year, good hay was obtained, but there are still spots which are too salt for vegetation to grow on. Four acres which are set apart as a kitchen garden yield splendid crops of potatoes, peas, asparagus, carrots, turnips, and other vegetables.

Vast tracts, both in the British Isles and abroad, have been snatched from the sea during the last three centuries. The Fen Land is perhaps the largest tract thus utilised at any one part of our country. On the Continent, Holland supplies the most noted example of this kind of reclamation. The work is still going on, and the present industrious Dutch engineers are said to be thus adding to their country some 2470 acres of land every year.

Drifting Sand.—This is a common enemy in our own as well as in foreign countries. The sand is usually derived from the shore, and is swept landwards by prevalent sea-breezes. It advances in great billows, with steady and remorseless step, devastating the fields and gardens that may lie athwart its path. The well-known Sands of Culbin, on the Moray Firth, destroyed the estate once known as "the granary of Moray," and, in Aberdeenshire, the same fate befell the greater part of the parish of Forvie, where many farms now lie buried beneath a waste of barren sandhills.

To reclaim such ground, and sweep away the sand, is of course impossible. All that can be done is to make the best of a bad job, and prevent the sand from working any more mischief by endeavouring to arrest its further progress. This can be done in one way only. The surface of the sand must be protected from the wind, and bound together by planting it with marram-grass or some varieties of trees that can thrive on an arenaceous soil. Among these, *pinus maritima* is one of the most useful species. By its help, large tracts of blown sand have been reclaimed in France, where dunes are very prevalent. The sand-dunes on the Continent seem to have been covered with forests at one time, but during the evil days of the Middle Ages these were cut down, and the loose sand below, being once exposed, was set in motion by the wind, and another monument to man's recklessness was soon reared, which centuries of intelligent toil have scarcely sufficed to demolish.

Want of Soil.—There are extensive tracts in Scotland where the

soil is not only too poor to be worth improving, but, as a matter of fact, is almost entirely absent. On the wild, western coasts of Sutherland, for instance, southwards from Loch Inchard, the whole district resembles an angry sea of bare gneiss hummocks, with almost no vestige of soil, and scarcely any vegetation. Such districts are absolutely unfit for agriculture, and are nearly as useless for sheep-farming, and unless they can be used as deer forests their value is small indeed. A piece of land of which it takes twenty acres to feed a sheep, and that has no good ground for wintering, is quite unfitted to support comfortably even a sparse community. Fortunately, all parts of the Highlands are not so thinly clad with soil. Much misconception exists as to the distribution of habitable ground in the North. But this can be removed easily, as part of the work of the Geological Survey consists in mapping, on the scale of six inches to a mile, the areas which are covered to an appreciable depth with drift, or glacial *débris*, and alluvium. In our valuable Geological Survey maps an accurate record is thus preserved, not only of all the different rocks and their structure, but of all the soils and arable or pastoral ground in the country, so that any one who wishes to know the real condition and possibility of improvement of any place that has been surveyed, has but to apply to the Survey for the desired information.

There are districts where there is too little soil for grazing, but where trees might be planted. There are other places, again, such as the Ceathramh Gharbh, or Rough Quarter, between Scourie and Rhiconich, where the rock is so bare that not even trees would grow.

Where this is the case, unless some other source of employment than farming is to be had, the population would be far better away, both for their own and their country's sake. But I think that something might be done to better the condition of some of the West Coast crofters if more attention were paid to various kinds of fishing. Lobsters are at present caught in considerable quantities and sent to London. Scotland is also pre-eminently suited for pearl-fishing. With the exception of China and a few rivers in Bavaria and the United States, Scotland is the only home of the pearl-mussel. Pearls are found in the Teith, the South Esk, and in several of our Highland rivers, and the cultivation of the mussel might here, as in China, be made a very profitable industry. Several of the sea lochs are well adapted for oyster-culture, which is a very profitable kind of farming along the coast of France and elsewhere. With enterprise and skill, these and other possible sources of employment could be turned into actual facts, but where the will is wanting nothing will ever be accomplished. The West Coast crofters are undoubtedly lazy, and it is to be regretted that there is so little of the old Scottish spirit of independence about them, and so much looking to Government and political agitators for help from without. It is true that means of communication are bad, and encouragement to work is small; but there is much truth in the adage that fortune favours the brave, and were there is the will the way would no doubt be soon smoothed down. In the broad waste lands of the North there is, I cannot but think, room enough, each in their proper place, for deer, sheep, grouse, crofters, and tourists. What seems chiefly wanted is a better distribution, and a rearrangement of the population, a graded

system of farms, and more intelligence and patriotism all round. There is a place for everything if it could only be found. Some districts are adapted for reclamation, others for reafforesting ; whilst others again are absolutely unfitted for agriculture, pasture, or trees, and ought to be cleared of their starving population and relegated to deer or other game. Deer and sheep can thrive together quite well, and many a good stag is annually bagged on a sheep farm. It is a pity, economically speaking, that so much of the Highlands is under deer forests, for it may happen, as it does this year, that no tenants can be found for many of the forests, and in such cases the value of the ground is reduced to less than *nil*, whereas if the land were stocked with sheep, as well as deer, it would always yield a certain rent. It is quite a mistake to suppose that deer are liable to be disturbed and made more wild by a few pedestrians crossing the hills before the stalking season begins. The experience of my colleagues of the Geological Survey and myself, during several summers spent in smiting the mountains and constantly disturbing the antlered monarchs in the deer forests of Sutherland and elsewhere, has all gone to prove that, the more strangers the deer see, the tamer do they become, and the better is the sport when the stalking begins. Tourists and summer visitors should, from a landlord's point of view, if not from any other, be encouraged to visit poor districts, for they do not come empty-handed, and the wealth they bring always helps to promote what is sorely wanted—the circulation of money among the inhabitants. They thus help the poor people to pay their rents, and in so doing conduce indirectly to the utilisation of the waste lands. It would not be at all surprising if the Access to Mountains Bill, were it to pass into law, would in this light be found to do much more real good than harm to the value of our beautiful but barren northern territories.

In conclusion, it must be remembered that waste lands cannot be reclaimed to any purpose by imposing and spasmodic schemes, or sudden outbursts of energy and floods of money and machinery. It must, to be permanently useful, be a gradual and systematic process extending, perhaps, over generations. The people on the ground must be encouraged to do for Scotland what the Germans have done for their once barren plains, or the Dutch for their once submerged meadows—work hard and constantly, removing each day a stone, and substituting for it a tree or a handful of corn, and teaching their children to follow their example and not look to prating demagogues for help. All that Parliament can do is to help people to help themselves, and remove unjust obstacles to their so doing. Landlords, too, have their duties as well as their privileges, and in these present evil days, when only the fittest survive, they will find it more and more necessary to direct their attention to such subjects as I have touched on in the foregoing pages.

GLEN DOLL.

Glen Doll, which has been so frequently mentioned in the newspapers during the last two years, is a short but deep valley descending from the hill named Tolmount, on the confines of Forfarshire and Aberdeenshire, and joining the North Esk at the farm of Braedownie, about four miles north from the Kirkton or Millton of Clova. As the public have used the glen most from south to north as a route from Clova to Braemar, we shall begin our description at the southern end. Clova itself, or as it used to be called, Cloveth, is a mere hamlet with a church, a mill, and an inn, in the higher part of Glen Esk, about 10 miles from Cortachy. The name of Glen Clova is given to a stretch of nearly 15 miles of Glen Esk, a broad and beautiful pastoral valley, with plenty of farms and cottages on both sides of the river. Not much is known of the history, topographical or otherwise, of Clova. A few notes have been collected in Warden's *Angus or Forfarshire*, i. 70-75 *et passim*. It appears that, in 1324, the Bruce granted Clova to Donald, 12th Earl of Mar. In 1398, it became the property of the Earls of Crawford; and it was this Lindsay family that built the old Peel or Fort of Clova. In 1445, for certain politic reasons connected with the feudal wars of that part of Scotland, the famous Lindsay, known as Earl Beardie, gave Clova to Thomas Ogilvy, and with one or other branch of that numerous clan it has since remained. In 1684, one of the Ogilvies, named David, built the mansion which for some time existed at Millton. This fact is still recorded by a stone which bears the semblance of a heart with the initials D O on one side, and J G, for his wife, Janet Guthrie, on the other. When Charles II. made his famous "Start from Perth" he ran off to Clova. The place remained Jacobite for a long time, and in 1746, Major La Tauselle was sent by the Duke with a special force to look after the traitors in that neighbourhood. From a remote time there was at Clova a Chapel of the Blessed Virgin, annexed to the Church of Glamis, and belonging to the Abbey of Aberbrothock. In 1574, the readership of Clova was stated to be worth £20 Scots. The slow advance of enlightenment may be seen in the fact that, in 1662, a poor woman named Margaret Adamson was burned there as a witch; and in the same year the local Presbytery found it necessary to prohibit the barbarous custom of bringing a piper to church on occasions of marriage. In 1855, the present church was built at Clova, the old "jougs" being sent to the National Museum, and, in 1860, the district was erected into a *quoad sacra* parish.

There are two or three roads going north from Clova to Deeside, the best known of which are Glen Doll and Capel Mount. Only one of these is mentioned in Sir James Balfour's "Collection on the severall Shires," which was made about 1650, and is preserved in manuscript in the Advocates' Library. We print the list in which this road occurs, as it is of great interest:—

"The chief passages from the river Tay to the river Dee through the mountains, also from Aberdeen to the head of Dee, are eleven, viz.:—

1. The eastermost is Calsay or Couey Mounthe.
2. Elsicke Monthe, and goes from Stainhuie to Drum, six miles of mounthe.
3. Cragincrosse Mounthe lies from the Church of St. Palladius, vulgarly called Pade Kirk in the Mearns to the Mylles of Drum.
4. Stocke Monthe, which is the fourth passage, from Glenbervie in the Mearns to Straquhan on Deeside, and contains six miles of mounthe.
5. Mounthe Bulge is fifth, and lies from Glen Farquhar to Deeside.
6. Cairncamounthe is the sixth, which passes from Fettercairn in the Mearns to Kincardine of Neill on Dee in Mar, and contains eight miles of mounthe.
7. Seventhly is the Forest of Birsse, which lies from Cairncorss to Birss on Deeside, and contains six miles of mounthe.
8. Eighth is Mount Gammell, which lies from Glen Esk to Glen Tanner on Deeside, and contains six miles of mounthe.
9. The ninth is Mounthe Keene, which lies from Invermarkie to Canakyle on Deeside, and contains ten miles of mounthe.
10. The tenth is Capell Mounthe, which lies from Clova to Glenmuick on Dee, and contains twelve miles of mounthe.
11. The eleventh is Carnavalage, which lies from Glenshee to Castleton in Brae of Mar, and contains miles of mounthe.

"*Note.*—That the chief passage from Castleton in the Brae Mar to the Castle of Blair in Athole is called Potarffe, and contains eighteen miles of mounthe."

It will be seen that the Capel Mounthe is described as going to Glen Muick, from the spital of which it descends to Ballater, or by Inshnabobart to Crathie. Glen Doll, on the other hand, reaches the Esk water almost opposite to the starting-point of the Capel, and with the exception of the Bachnagairn Road by Loch Esk and the Gowal Burn, which form the proper sources of the Esk, is the only direct road from Clova to Castleton of Braemar. The Capel road is said to have twelve miles of mounthe, that is of hill, before reaching a made road. Originally, Glen Doll may have had a longer stretch of mounthe, but now in consequence of an excellent road having been made from Braemar to Loch Callater, Glen Doll cannot boast of twelve miles of mounthe. The distance from Clova to Braemar is only about 18 miles, and from this has to be deducted, not only the distance from Braemar to Loch Callater at the north end, but the four miles between Kirkton and Braedownie or Acharn, at the south end. The Ordnance Survey map, and even the reduced maps in Black's Guide-book, show clearly enough the general nature of the road through Glen Doll. Reserving the details of the route in the meantime, the road leaves the county highway and the Esk water at Braedownie, at an elevation of less than 1000 feet, proceeds up the glen, ascending gently for about two and a half miles, then suddenly zigzags up to the 2500 level, reaches its summit between Tolmount and the Knaps of Fafernie, at a height of about 2900, whence it rapidly descends 1300 feet in two miles, to the level of Loch Callater (1627), and continues down the glen to the farm steading of Auchallater, at which point (about two miles from Braemar) it joins the highway road from Glenshee, which now takes the place of the old Carnavalage or Cairnwell road. It is by this line of road that, as was shown in the recent

litigation, sheep and cattle were habitually brought over to Cullow market from Braemar market, and that, as may be hoped, pedestrians in the future will go habitually in all the summer and autumn months. Glen Doll proper is of remarkable beauty. The Crags of Craig Mellon, Craig Rennet, and Craig Maud, the corry of Glen Fee, the Falls of Feula and Fialzioch, the extraordinary staircase called Jock's Road, the long gentle slope of the White Water, the rocks encircling the head of Glen Callater, the exquisite corry of Loch Ceann Mor, Loch Callater itself, all these are great outstanding features. The higher summits of the district, such as Lochnagar on the north, and Glas Meall on the south-west, are well seen at certain points. On the north is the charming glen of Bachnagairn, with Loch Esk and the Falls of Gowal. Immediately to the south of Tolmount are the two wonderful glens, Canness and Caenlochan, which have excited the admiration of botanists so much. Indeed, the whole of this upland district has been for generations a sort of happy hunting-ground for botanists. It was the favourite gathering-ground of that remarkable man, Mr. G. Don, who, after serving his apprenticeship as a watchmaker in Forfar, became the assistant to the Professor of Botany at Glasgow, and afterwards transferred himself to Edinburgh. But he is only an example of a crowd. Professor J. H. Balfour used to go yearly with his students to Clova, and no doubt if the Ogilvy of that day had behaved as the Duke of Athole did in Glen Tilt, the Professor militant would again have arisen in his might. Fortunately, Mr. Ogilvy was a sensible man, and never disputed the public right to pass through Glen Doll. The description of the glen in the Introduction to William Gardiner's *Flora of Forfarshire*, published in 1848, shows with what profound feelings of admiration and delight the botanical world regarded all this district. Gardiner mentions that the path to Braemar crosses the Esk by a wooden bridge, goes past the farm of Acharn, winds round the base of Craig Mellon, and past rocks which are a paradise of Alpine flowers. The Fall of Feula, he says, "looks like a silver thread suspended among the verdant and flower-garnished cliffs." He mentions the numerous rare plants, cryptogamic and others, and the mosses, lichens, and hepaticæ which clothe the trunks of the old birch trees. Gardiner then describes the steep rugged path called Jock's Road, which leads up to the shieling of Lunkart, where, he says, "the botanist will find a hearty welcome to such shelter as it affords." We are afraid that there is now no host to give a welcome. The original station for the *Carex rariflora* is close to this shieling. Mr. Gardiner next goes into ecstasies over the *Gentiana nivalis* of Caenlochan, and mentions that, at the junction of the Canness and Caenlochan glens, and opposite the hill Monega, there was in his time another shieling "where the weary botanist is never denied a night's shelter." The deer in Caenlochan, he says, were never afraid of flower-hunters, and, indeed, why should they be? Gardiner further mentions that there is a footpath from the head of Caenlochan into Glen Callater. This joins the track from Glen Doll and passes down the lake-side to Braemar. It is delightful to see the honest love of nature reflected in the books which scientific students have written about this country. The geologists as well as the botanists fell in love with it. Here is a description given, in 1855, by William MacGillivray,

Professor of Natural History in Aberdeen University, the distinguished author of the *History of British Birds.* In his very pleasant book on *The Natural History of Deeside and Braemar*, he says, after describing his walk over the top of Glas Meall to Caenlochan :—

"This is the most lovely specimen of a corry to which there is nothing equal in the neighbouring county, either in its beautiful proportions or in its brilliant verdure, much less in the number of its alpine plants. It is bounded by rugged precipices, scarred and shattered, grey, black, red, and of various tints, some of them seamed with white quartz, and all overspread with shelves of bright green grass, on which grows a profusion of alpine, subalpine, and upland plants, mingled with those of the valleys and plains. Stony declivities alternate with grassy banks slanting away into a hollow, covered in part with the most beautiful verdure, in part with patches of bog-peat, contrasting singularly by their deep black. Pools, it is said, form there in wet seasons, and in cold summers the snow lies long in the hollows. At present there is neither snow nor water, excepting that of two small rills creeping along to join the stream in the further part of the valley. On the right are two great masses of red porphyry, separated by a scar. The nearer margin is abrupt, and there is interposed an avalanche of detritus between it and a narrow and low ridge of rock, also chiefly of porphyry, which in like manner is succeeded by a broad scar. Then forming the upper part of the valley is a great fissured rock of hornblende, varying in texture, sometimes approaching to claystone, sometimes resembling greenstone. Red porphyry also appears in it in the form of a vertical dyke ; and there are intermixed masses of a kind of mica-slate approaching in texture to clay-slate. Then comes a very steep grass declivity, and beyond it a more abrupt space, with dark scars, looking as if formed in serpentine. The rock, however, is a dark-coloured somewhat micaceous clay-slate. The clay-slate at the head of Caenlochan is in very thin, undulating laminæ, glistening, generally so soft as to be easily impressed or grooved by the nail. The colour is blackish grey, that of the powder pale grey. It is meagre to the touch, generally soft, often unctuous. There is scarcely any quartz in it, but it contains iron pyrites and protoxide of iron, and the laminæ of the slate itself are often coated with an iridescent film. Part of the rock at the head of the glen—that which is most productive of plants—is of mica-slate, composed of laminæ of mica and quartz. The texture and aspect have been altered by an irregular mass of trap, in the vicinity of which it has become compact, the quartz assuming a semifused porcellanic appearance. This trap is an extremely tenacious hornblende rock of crystalline texture, with uneven indeterminate fracture, and having a very little granular quartz intermixed. The porphyry is various ; generally it is of a deep flesh-red tint, compact, with uneven somewhat splintery fracture, and having small irregular crystals of transparent quartz, as well as crystalline felspar interposed : sometimes it is granite. It often contains larger crystals of red felspar along with chlorite. The granite has a very peculiar appearance, being porphyritic and variegated, with a basis of grey and flesh-coloured compact felspar intermixed with greenish black mica, and having conspicuously interspersed through it crystals of albite, and fragments or concretions of white quartz. It is easily frangible with uneven fracture."

We also recommend Professor MacGillivray's description of the corry of Loch Ceann Mor, about 8 miles up Glen Callater, in which, he says, Mr. Macgregor, the tenant of Auchallater, pointed out to him a little hut built by his shepherds, having in it a place for a small fire, two stone

benches, and two recesses in the walls for pipes and other articles. On the rocks of this corry, Professor MacGillivray mentions that the shepherds have sometimes been obliged to let down a man by a rope to the distance of 150 feet in order to rescue sheep which had been enticed by the shelving verdure. A remarkable circumstance is that "the daisy and the Alpine *Erigeron*, the common and the Alpine lady's mantle, the wood-sorrel and the oxyria, the blue-bell and the mountain saxifrages grow side by side." In this corry, vast quantities of snow lie unmelted until late in the spring. Immediately above the little loch is the famous *Eas-all'-brist-amhach*—the fall of the breakneck brook. At the foot of this fall is the Clach-Mhaduibh, "the stone of foxes." Professor MacGillivray gives a full list of the Alpine plants found in this corry in 1830. He also, with mock gravity, records the fact that on a certain green hillock near Auchallater, a man, still living at the date of his visit, had seen the fairies dancing, with a piper playing to them.

One is bound, in giving an account of a Highland glen, to discuss the meaning of the local names, but for this, unfortunately, there does not seem to be any sufficient material in the case of Glen Doll. There is no accessible record of the older names of places, and the record of the Ordnance Survey is not supposed to be very reliable. Doll itself may be assumed to be a form of the Celtic word for valley, which is akin to *dail* and *dal*, occasionally used with the meaning of field. Braedownie explains itself. Acharn is no doubt the field of the farm. Driesh is a singular word, and sounds like the German *Driesch*, or fallow ground, but may be a form of *dreas*, thorns or brambles. Mayar may be connected with the Gaelic *magh*, of which Machaire (the Gaelic name for the low country of Scotland) is a derivative, and may refer to the level stretch of mountain top. Kilbo is mysterious, the termination having some reference to cows; can it mean the cow-byre? Cul-bo would mean the back of the cow, but that is equally mysterious. Tom-buidhe is, of course, the yellow or golden hill. Tolmount, also spelled Tulman, may be *tolmach*, abounding in hillocks, or may be connected with the word *toll*, which means a hollow or crevice. Cairn-na-Glasha, the hill by the little stream; Glas Meall, the grey hill; Cairn Bannoch probably means the cairn of the little hill, or it may refer to the peculiar form of the hill; Creag nan Gabhar, the rock of the goat; Meall an Sluichd is the hill of the pit or den, perhaps referring to the pool or lake upon it; Sron Dubh, the black nose or promontory; Cairn Lunkart may perhaps be the hill of the sluggard (ironically); Cairn Damff, the hill of the stag. Kilrannoch is a singular name, the latter part of the word seems to mean poet or singer, perhaps the hill called by Professor Macgillivray, "the Learner," although this sounds suspiciously like the "Learmour" of the Ordnance Survey. Many of the other hill-names are well worthy of attention: *e.g.* Sneck of Farchal, Shank of Drumwhallo, The Ought, The Rives, The Knaps of Fee, The Dacies. The "Strone" of the Survey seems to be a corruption of the Gaelic Sron.

Such are a few rough notes on the Glen Doll road and country. Long may it continue to be the favourite haunt of all lovers and students of nature.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

THE last ordinary meeting of the Geographical Club was held in Edinburgh on Saturday evening, the 26th May, when Mr. F. Grant Ogilvie, Principal of Heriot-Watt College, submitted for discussion a paper on *Studies in Local Geography*. On Friday, the 15th June, on the invitation of Mr. Robert Cox, of Gorgie, an expeditionary party of the club visited Loch Lomond, where a series of soundings were taken, under the direction of Dr. H. R. Mill.

GEOGRAPHICAL NOTES.

EUROPE.

Earthquakes in the Highlands of Scotland.—At a recent meeting of the Inverness Field Club, a paper on earthquakes in the Highlands was submitted by Mr. Horne, of the Geological Survey. It appeared probable, he said, that the latest shock experienced in this country, that of 2d February of the present year, originated in the Great Glen and near Loch Ness. It reached Inverness at 5.1 A.M., Fort-William at 5.3, Ardnamurchan at 5.5., and Banff at 5.9. To the south, the shock was felt at Ballinluig at 5.2 A.M., and at Edinburgh at the same hour, from which it may be inferred that an independent centre of disturbance existed somewhere in the eastern Highlands, probably on the borders. Referring to previous earthquakes, it was stated that the shock experienced in November 1880, extended over an area of 19,000 square miles, apparently originating near the Fladda Lighthouse, and travelling over the land at a rate of 4·6 miles per minute, and over land and sea at a mean rate of $5\frac{1}{2}$ miles per minute. A remarkable point of contrast between the two disturbances described was, that the loud rumbling noise, generally accompanying such shocks, was heard, in 1880, only near the point of origin ; this noise, on the contrary, was distinctly heard, during this year's shock, over the whole area of disturbance. Another interesting point to which attention was directed, was that out of twenty-two lighthouses situated on Archæan rocks, Cambrian sandstones, and the Eastern schists, one half experienced the shock in 1880 ; while, on newer rocks, only two out of thirteen felt the effects. Mr. Horne considers that the line of fracture along the Great Glen dates back to an early geological period, and may even be referred to a time anterior to the laying down of the Old Red Sandstone of the Highland plateau. The newer rocks have fallen down into this fault, and are piled against the hard crystalline rocks on the north-west side of the dislocation. During the Lower Old Red Sandstone period, a line of active volcanoes appears to have studded the eastern Highland border, and discharged great quantities of lava and ashes to a thickness of several thousand feet. In the Tertiary period, extraordinary volcanic activity existed in the West Highlands. This state of plutonic activity gave rise, as has been stated by Dr. Archibald Geikie, to tremendous tension in the earth's crust, resulting in fissures through which the molten matter poured out from the interior reservoirs. Since that period the volcanic forces have been too weak to burst forth into activity, but still are able to indicate their presence in the modified shape of earthquakes. That disturbances of this nature should occur along the line of the Great Glen is, from the geological history of the district, what might very naturally be looked for.

Polish Population.—M. Czinski has just published at Varsova a work on the total number of Russian, Austrian, and Prussian Poles, of which the following is a *résumé* :—

The total population of the kingdom of Poland, according to the census of 1886, is 7,357,375 inhabitants, of whom 5,400,000 are Poles, the remainder being composed of Jews, Germans, Little Russians and Great Russians. In the provinces of White Russia and Lithuania, there are 958,056 Poles, and 23,000 in the Courland Division, Russia. This gives a total population of 6,381,056 Poles in Russia. In Austria the number of Poles is 2,922,300, and in Prussia, 2,672,000. The three fractions of Poland therefore make together the grand total of 11,975,356. *Le Mouvement Géographique*, 6 May, 1888.

ASIA.

The Syr-Darya Territory.—The following particulars regarding the condition of the Syr-Darya territory, derived from Russian official sources for the year 1885, will be found of interest, especially in view of the ever-increasing importance to which Turkestan is rising. They are extracted from Vol. xv., No. 2, of the *Proceedings of the Berlin Gesellschaft für Erdkunde*, which was indebted for them to the *Russian Review* (Vol. xvi., No. 4). The area of this territory comprises about 8230 square miles, of which about 1300 consist of oäses under cultivation. Four-fifths of the whole territory, embracing its north and north-western parts, are steppes and sandy wastes unfit for cultivation, while the south-east parts have a rich and very deep, loose soil, which, without being manured, produces, if properly irrigated, two crops annually. The Syr-Darya, by reason of its continuous and shifting sand-banks, and the sinuosities of its course, is quite unsuited for navigation, and serves at best but as a waterway for rafts. Its chief importance lies in the possibility of its being used, as in ancient times, for the main artery of a very extensive itinerary system. The hill forests consist mainly of juniper, pine, birch, nut, wild-apple and plane trees, but sad havoc has been made of these in the course of the last ten years by a French Company, which bought up and carried away vast quantities of the walnut wood with which these forests teemed. The denudation of the hill-slopes was followed by the usual pernicious results—the greater irregularity, as well as the diminution, of the supply of water carried down by the mountain torrents to the rivers which permeate the plains, and the sterility to which large tracts of once fertile country have in consequence been reduced. The Russian Government, it is true, in 1879, issued an edict for forest protection, but as no adequate measures were taken for its enforcement, it has proved ineffective. In the oäses, however, the forests when wasted recover with wonderful rapidity, owing to the great fruitfulness of the soil. They consist chiefly of poplars, willow trees, cork, elms, and mulberry trees. The poplars yield timber wood within twelve years. The willows, which are cultivated for fuel, grow twice as fast.

As regards the population, people of Aryan descent occupy four-fifths of all the area under cultivation, while Turanians occupy the remaining one-fifth, together with all the steppes and waste lands. The population of the territory amounts to about 1,213,000, of whom 869,000 are Turanians, and the remaining 344,000, Aryans. The Russian Government has taken measures to protect the inhabitants from the evils incident to a community composed of mixed races which have conflicting political views and interests. It accordingly discourages immigration from Russia, and has from time to time forbidden Russians from purchasing landed property outside of the town boundaries, or in the neighbourhood of post-stations. The planting of Crown colonies at certain fixed points

has proved a complete failure, but the free settling of peasants, which since 1877 has been permitted on certain conditions, has afforded good results. In 1885, there were 8 settlements of this sort, and 4 German Mennonite colonies, with 514 families, and about 2500 persons. The entire Russian population amounts to about 20,000 men. Of the settled population of Aryan race, the most numerous tribe is the Sarten, with 160,000, and next to it the Tajik (the Sogdians of antiquity), with 130,000 souls. These two tribes form that element of the population which is most susceptible of industrial development. Two tribes of Zigeuner count in all about 600 families, and these are Mohammedans. There are but few Indians to be found, and these occupy themselves chiefly with usury in sundry of its forms, and return to their own country as soon as they acquire proper means. The most numerous people of the Turko-Mongolian race are the Kirgiz, the descendants of those Turkish hordes which for a thousand years terrorised Europe and Asia with their destructive inroads. Their number is about 730,000, and, of these, most lead a nomadic life. The settled tribes are to be found only in the southern parts. Thus the Kuraminzen, which are in number about 80,000, are settled south from Tashkend, in the valley of the Anshenow. More distant still are the Karakalpaken, who are the best agriculturists in the Kuraminsk circle. In the most easterly part of the territory, the Karakirgizen, who are a sturdy race of hill-men, 47,000 in number, have their seats, and extend as far as the Pamir region. The Usbeks, who are also a stout race of men and number about 88,000, are found on the southmost border towards Sarafshan. The Tartars, who number 3000, originally came from Russia, and these, on account of their knowledge of the Russian language, fill many of the lower posts under Government. Jews are found especially in Tashkend, whither they have either wandered in recent times from Russia, or have come originally from Persia and Buchara. They number about 1600.

With respect to the forms of religion professed in the territory, 20,000 are Christians, 1,190,000 Mohammedans of the Sunni sect, and 1600 Jews. In the year 1885, the number of cattle was estimated at three millions, of which half-a-million belonged to the settled tribes. The number was much greater up to the winter of 1879-80, when many of them perished in the heavy snowfall, which led to a great scarcity of fodder. In the Syr-Darya territory, as in that of the Amu, the production of cotton is now beginning to play an important part. The extraction of oils from various vegetable products, as sesame, poppy, and the kernels of cotton and apricots, is a reviving industry, and is now prosecuted with appliances for improving the quality of the oils. These industries, in connection with silk culture, and the production of wool, and the manufacture of leather, for which there is a superabundant supply of proper raw material, warrant the expectation that a great future awaits this region were it but once supplied with improved means of communication, with capital, and with men of energy and enterprise.

Population of China.—The *Journal* of the Statistical Society for December last contains particulars of the mode in which the official census of China is taken. In every city, town, village, and hamlet, it is provided by law that, for every ten families there shall be a tablet, on which are to be written the names and number of the inhabitants. Ten families make a *chia*, and an elder is in charge of these. A bailiff or *pau chia* is set over every ten elderships, and is responsible for the registration forms being correctly filled up. The number of inhabitants in each place must be reported to the Imperial Board of Revenue every year. According to a statement published by the Board, the population of the Chinese

Empire, exclusive of five provinces from which returns had not been received, was in 1885, 319,383,500. The estimated population of the five provinces omitted was, 60,000,000. If this calculation be correct, the population of China would now exceed 379 millions. The population of British India, according to the census of 1881, exceeded 198 millions, with 55 millions additional for the Native States, or 253 millions in all.

Surveys on the Irrawadi.—We have again to thank the Irrawadi Flotilla Company for another most interesting report from Captain Rimmer, whose Surveys up the Irrawadi we have noticed formerly. From information received, Captain Rimmer believes that the Molay River joins the Irrawadi four miles above Bhamo; it is said to afford a boat passage up to the Shan town of Molay. The Mogoung River was ascended for a considerable distance by the surveyor, who reports rather favourably upon it as a future commercial highway. The course of the stream is frequently rendered difficult and dangerous by rocks, boulders, and snags; but these could be cleared out without great labour or expense. The rocks not only block up the stream when the water is low, but, during floods, are the cause of whirlpools. The river is well confined by high banks, bordered alternately with clumps of jungle grass and thick forests. Sandpits have been formed at most of the bends of the stream. Elephants, tigers, leopards, and barking deer are numerous along the banks, and peafowl are plentiful. From its junction with the Irrawadi up to the village of Mong-kong, the river-bottom consists of sand and clay; above the hamlet it is shingly, with several islands dividing the stream, causing an increase in the rapidity of the current. The temperature of the water was found to be considerably higher than that of the Irrawadi, the surface presenting an oily appearance, probably pointing to the presence of oil-beds in the vicinity. Fish were found to be plentiful, the large butterfish supplying the people with animal oil for their lamps. Fogs hung over the stream on most mornings and did not lift, as a rule, before 10 A.M. At the town of Mogoung, the highest point attained by the expedition, Captain Rimmer was attacked and wounded when assisting a Chinese acquaintance to guard his house and its contents from the Myouke of the town. The boats were also attacked on their way down stream, but no damage was done. The town of Mogoung consists of about three hundred houses, the inhabitants being Chinese, Burmese, Kachens and Shans. All the people appeared to be very friendly, and but for the presence of the Myouke, Captain Rimmer's visit would in all probability have been a peaceful and pleasant one. Captain Rimmer has done most excellent work on the Irrawadi, and all his reports have been clear and full. We hope it may not be long before the country begins to reap the benefits which ought to result from his labours.

Earth Tremors and the Wind.—Professor John Milne contributes to the *Quarterly Journal* of the Royal Meteorological Society (January 1888) a paper on the relation of earth-tremors and the wind. The general conclusions he arrives at are stated by him as follows:—

1. "Earth tremors are more frequent with a low barometer than with a high barometer, but even with a low barometer it may often happen that tremors are not observed.

2. "With a high barometric gradient tremors are almost always observed, but when the gradient is small it is seldom that tremors are visible.

3. "The stronger the wind the more likely it is that tremors should be observed.

4. "When there has been a strong wind and no tremors the wind has usually been local, of short duration, or else blowing inland from the ocean. We must

not, however, overlook the fact that such winds are occasionally accompanied by tremors.

5. "When there has been little or no wind in Tokio, and yet tremors have been observed, in most cases there has been a strong wind in other parts of Central Japan. In the case of winds working up from the south-west this has been very marked, tremors being felt in Tokio several hours before its arrival. When neither wind nor tremors are to be observed in Tokio, there is usually a general calm in Central Japan.

6. "From 75 to 80 per cent. of the tremors observed in Tokio may be accounted for on the supposition that they have been produced either by local or distant winds.

7. "The only connection between earth tremors and earthquakes in Central Japan is that they are both more frequent about the same season.

"It now remains to discuss the probability of earth tremors being produced in the manner which these results indicate. Among the various objections which may be brought forward to show that earth tremors are subterraneous phenomena, and are not surface disturbances produced by the wind, the following may be mentioned:—In Italy, where more has been done for microseismical investigation than in any other country, the general opinion, based upon observation which, I regret to say, I have not the means of consulting, is that tremors are not related to the wind. Professor de Rossi finds tremors as marked at Roca di Papa, 18 mètres under ground, as he finds them on the surface. Many tremors are undoubtedly connected with earthquakes. In Japan, however, I do not observe any connection with earthquakes more than that each are most frequent during the same seasons.

"The fact that 25 per cent. of the tremors I have observed cannot be accounted for on the supposition that they are produced by wind, suggest the possibility that in all the other cases where tremors appear to be connected with a local or a distant wind may be accidental coincidences between the time of subterraneous activity and atmospheric disturbance, it being assumed that in eighty days out of every 100 that wind is blowing somewhere in Central Japan.

"In support of the supposition that many earth tremors are superficial disturbances, we may refer to the universal experience that heavy winds will deflect chimneys and shake trees and buildings. These, reacting at their foundations, shake the ground; and that local winds may in this way produce local tremors is a fact which I think will be generally admitted. To show that tremors may be propagated to the distance of from 100 to 300 miles is, however, a more difficult matter. We know that on ordinary ground a gentle stamp may be seen reflected as tremors in a dish of mercury at a distance of 150 feet. The movement of a railway train may be recorded by its tremors at the distance of a mile. If the tremors produced by quickly rocking a block of wood on ordinary ground are observed at some distance reflected from a surface of mercury, it appears that there is a short interval in time before they reach their maximum. May not this be an indication that the distance to which tremors originating from a given source may spread, is partly due to the length of time that the force producing them is in action? From five days' observation with a tremometer on the top of Fujisan (12,400 feet), during which time a strong wind was blowing, I observed not only tremors of considerable amplitude, but also what may have been a deflection in the vertical. On the assumption that this mountain was made of brick and it was exposed to a wind pressure of 40 lbs. on the square foot, Professor Alexander calculated that the deflection ought to have been greater than that which was observed. With these facts before us

it does not seem improbable that a gale of wind blowing against the side of a range of mountains 5000 to 7000 feet in height should produce a disturbance upon their leeward side extending many miles. The observations which I have made certainly indicate that such disturbances exist, and if they are confirmed it will not be long before meteorological observatories will regard tremometers as important additions to their equipment."

AFRICA.

Lieutenants Kund and Tappenbeck.—We have twice referred briefly to the expedition of Lieutenants Kund and Tappenbeck into the Batonga country. In the *Deutsche Kolonialzeitung* for May 12, there is a long letter from Lieutenant Kund relating to the check his expedition met with at the hands of the natives. A few details will be interesting to our readers. On the 5th of October, 1887, Lieutenants Kund and Tappenbeck, accompanied by Dr. Weissenborn, a zoologist, and Mr. Braun, a botanist, landed at Great Batonga. A month later, the expedition started from the mouth of the Kribi to explore the unknown country to the east. After considerable difficulty, and much tedious marching through an uninhabited virgin forest, they arrived at the mountains which fringe the great Central African plateau, and there met with a great river flowing towards the west which proved to be the river that receives the Malimba and Quaqua streams, and flows into the sea south of Kamerun. It is called the Ndjong, and upon its right bank the expedition unexpectedly arrived at the boundary between the Bantu and the Soudan negroes about 300 km. from the coast. The people living here were very unfriendly, as a result of being continually harassed by the Mohammedan slave-hunters. They live mostly in large fortified villages, and, owing to the want of interpreters, it was impossible for the expedition to make friends with them. These Bakokos, as the natives are called, attacked the expedition again and again with a cunning and strategy which Lieutenant Kund says he had never before seen amongst Africans. Lieutenant Tappenbeck was shot near the right ear, and fell unconscious to the ground. Lieutenant Kund was first wounded in the forehead, and then twice in the elbow, which rendered it impossible for him to use his gun. Twenty-six of their men were wounded, and ten were killed. They were compelled to retreat, having very little ammunition left, and their return to the coast was rendered extremely difficult, partly on account of the high grass through which they had to push their way, and partly by the natives, who followed them and kept up an almost continuous fire. After fourteen days of such difficulties, said by Lieutenant Kund to be almost indescribable, the expedition arrived at the forest which lies to the east of Batonga. It took them seven days to march through the forest, and they were almost starved, as they could find no food with the exception of a little fruit. They marched, from early morning until late at night, when at last a detachment from the gunboat *Cyklop* came to their assistance with plenty of provisions. Lieutenant Tappenbeck remains under the care of Dr. Weissenborn at Batonga. Lieutenant Kund has been obliged to return to Europe on account of his wounds. It is expected that the geographical results of this expedition will be of considerable importance.

Emin Pasha.—On the 5th of June, Dr. R. W. Felkin received a long letter from Emin Pasha, dated Kibiro, Lake Albert, Nov. 2, 1887. Emin Pasha was well, and just contemplating a journey into the Lendu country. He had heard nothing of Mr. Stanley. He had finished his survey of the Albert Lake, and hoped to send his results by the next mail to Dr. Felkin. He had received some more goods from Uganda, and on the whole everything in his province was

in a satisfactory condition. The desultory war between Uganda and Unyoro still continued. Amfina, the ruler of northern Unyoro, is dead, and Kabrega has taken possession of his territory, as also of the Kodj district, which was formerly ruled over by Rionga, so that at last the whole of Unyoro is under Kabrega's direct rule. He was, however, having considerable difficulty with his people, and had ordered the execution of forty of his petty chiefs. Emin Pasha thought that this order would be carried into effect, but he did not think that Kabrega's influence would be strengthened by it. Nearly all the letters which have been sent to Emin have been destroyed *en route*. Captain Casati was still well, and remaining in Unyoro.

Mr. Stanley.—News from Mr. Stanley is anxiously awaited, and many probable and improbable suppositions as to his whereabouts, and the cause of the delay in reaching Emin Pasha, have found their way into the daily papers. Although news of his arrival was expected long ago, it is yet very difficult to believe that any disaster has befallen him, for it is well known how fast bad news travels in Africa. Dr. Junker, in an address given before the Berlin Geographical Society last month, expressed the opinion that, from the point reached by the expedition last August, there were two routes which Mr. Stanley might take, in order to reach Wadelai. He could either go due east from the Nepoko, through the unknown region to the south of the Albert Nyanza, or else he could take the route leading to the NE. or ENE., which would be longer, but Dr. Junker inclined to the belief that Mr. Stanley would choose this route because, when they met in Cairo, he had given him much information regarding it. Dr. Junker says that the direct route to the Albert Nyanza leads through a district inhabited by several small tribes incapable of much resistance. He thinks that, if the expedition chose this way, the people would flee, and that requisitions of food would have to be made. He does not think that it would be possible for Mr. Stanley to have communicated with his base, as he considers that even if twenty or thirty men had been sent, the inhabitants would have attacked them. This, however, does not explain why deserters should get to Aruwimi Falls, and messengers be unable to go. With regard to the northern route, which leads from the Mabode country into the Momvu district, Dr. Junker believes, from personal experience, that Mr. Stanley would have no difficulty in obtaining food for his expedition. He says that plenty of grain and cattle could be obtained, and that the roads are so good that the expedition would have little difficulty in making rapid progress.

Italy and Zanzibar.—In the *Deutsche Kolonialzeitung*, June 9, 1888, we notice an extra sheet dealing with the unexpected difference which has arisen between Italy and Zanzibar. The Italians, it seems, are not content with their claim of Massowah, and they seem to have instructed their Consul at Zanzibar to claim Kismayu and the district behind it. This country lies to the north of the strip of territory which is at present under the British sphere of influence. Germany has also laid claim to the country between the Jub and Tana rivers, they basing their claim on the contracts made between the late Dr. Juhlke and the native chiefs. It is said that the Italian Consul has lowered his flag at Zanzibar and broken off friendly relations with Said Khalifa ; and an Italian gunboat has been ordered to proceed from Massowah to Zanzibar to enforce the Italian Consul's claim. As Great Britain and Germany are both interested in this district, it is confidently hoped that some friendly arrangement will soon be established, and that difficulties may not be created by the introduction of a new Power on the East Coast.

AMERICA.

Patagonia.—The journey through parts of Patagonia, performed by Mr. Bell and a party of twenty-seven skilled assistants, soldiers, and Indians, has promise of good results, although the accounts which have as yet come to hand are very meagre and, in this way, unsatisfactory. The Rio Corcovado was struck by the explorers and partly examined. It was found to follow a most tortuous and winding course, there being at one part within a space of six miles no fewer than 600 bends. The Rio Teca was also surveyed along part of its course, but nothing of importance was observed. These streams have all pebbly beds. The Rio de las Vacas was the largest river met with, being 600 feet wide ; it runs in the direction of Chile, and has a sandy bottom. The Rio Cholila is described as a very narrow stream with low banks. The Rio Chubub was struck at a point supposed to be not far distant from the source, but the tempestuous weather prevailing at the time prevented any exploration of the head-waters. The country passed through was well wooded, and produced much grass, affording excellent pasture for the horses and cattle which the Indians rear in considerable numbers. Mountains and hills rose on every side, often scarred by tremendous gullies and precipices. Near the Teca River, vegetation ceases, with the exception of clumps of piquillin bushes, and the ground is covered with boulders and gravel. One immense block of stone was observed, 800 feet high, with a diameter of 280 feet, weathered into the shape of a monster cannon-ball. Guacanos and ostriches were frequently met with ; insects, especially in the latter stages of the journey, were remarkably scarce. Apart from the rivers, good water is extremely difficult to be had, that found in the "aguadas" being, as a rule, almost unfit to drink. The presence of fine springs is, however, sometimes indicated by the presence of clumps of tall grass ; but these are not frequent. The weather during the journey was exceedingly boisterous, and the explorers were continually exposed to heavy falls of rain and snow.

Argentine Republic.—Increased attention is being paid to the great southern territory of the Republic. Up to the present all the credit, capital, and enterprise of the Government have been directed to the central and northern territory, but people are beginning to see that the great development of the future must be sought in the southern zone. The day when immigration and capital seek new fields in the great southern pampas, in the valleys of the Rio Negro and Rio Colorado, at the foot of the Andes and on the shores of the South Atlantic, railways will stretch from ocean to ocean, and settlers from the northern parts of Europe will fill the deserts and start a country that will eclipse in growth what we have seen in the centre and north. There are already several schemes on foot to open up the south. The transcendental scheme at present is the railway from Bahia Blanca to San Luis : that will be followed by railroads up the Colorado, Rio Negro and Chubut valleys—comprising an immense country that needs only the hand of man and the lever of money to become a populous and producing zone. The valley of the Rio Negro alone ought to eclipse all the Santa Fé wheat colonies put together.—*Buenos Ayres Standard,* April 7, 1888.

OCEANIA.

Tahiti—Papeete.—*The Tahiti Annual*, published by the Government printers at Papeete, gives some interesting details relating to the French possessions in Oceania, which comprise the islands of Tahiti and Moorea ; the Archipelagoes of Marquesas, Tuamotu, and Gambier, and the Islands of Tubuai, Raivavae (Vavatu?)

and Rapa. Tahiti has an area of 104,215 hectares ; Moorea of 13,237 hectares ; the Marquesas Archipelago consists of eleven islands ; the Tuamotu Archipelago contains seventy-eight islands, the area of Tuamotu being 86,000 hectares ; the Gambier Archipelago comprises ten islets of a total area of about 3000 hectares ; Tubuai has an area of 12.75 square miles ; Raivavae of 6 square miles ; and Rapa Island has a circuit of from 30 to 40 kilomètres. The principal centre of population is at Papeete, which in 1881—at the last census—had 3,224 inhabitants, of whom about one-half were French, or of French descent. The importance of this town is said to be dependent upon the development of agriculture, but it is hoped that the piercing of the Panama Canal will exercise a healthy influence on the future of Papeete, since the colony will be put in more frequent communication with the mother country. According to the latest statistics, the whole of the French Oceanic settlements contained only a population of 23,127 persons. Papeete has a Chamber of Agriculture, and also a Chamber of Commerce, formed of nine members, nominated for six years, and renewable by thirds every two years. A Tribunal of Commerce exists, whilst in other directions, such as education, civil courts, etc., the colonies are well advanced in organisation. Great Britain is represented, as is the United States, by a Consul and Vice-Consul. Consuls look after the interests of Denmark, Germany, Chili, Norway, and Hawaii, whilst a consular agent only is maintained by Italy.—*Chamber of Commerce Journal*, 5th March, 1888.

GENERAL.

The Influence of Forests on Rainfall.—In the *Scientific News* for 27th January, 1888, a writer states that "one of the most important effects of woods upon a climate is that they promote rain. The theory of this process is not perfectly understood, but the facts themselves are matters of experience. There are districts on the Continent where the chief rivers have decreased notably in volume since the clearing of the districts about their sources. . . . In many districts of southern France the destruction of the forests has caused much more striking mischief. The rain, instead of falling as heretofore in moderate showers, now comes in violent gushes, with long periods of drought between. As the natural consequence, the grasses and other low-growing plants perish, their roots wither away, and the soil, no longer held together by their fibres, is washed away by the occasional violent rains, and carried down into the beds of the rivers. The hillsides of the higher plains remain as barren wastes of sand, gravel, and shingle." The author remarks that "a similar process has been going on in Spain, Italy, Greece, in Algeria, Marocco, and, in short, all around the Mediterranean." He states that in countries where afforesting has taken place by Government or other agencies, the climate has become less extreme, the rainfall more uniformly distributed, and the public health has improved. "Such beneficial changes have been distinctly recognised in North-Western India, where fertility is gradually returning to the deserts." In France, 250,000 acres of mountain-lands, and nearly the same amount of sandy coast-lands, have been replanted within the last twenty years, with the most satisfactory results. An eminent agricultural authority in the United States has given it as his opinion that if one-fourth of a country is left covered with trees, the remaining three-fourths will yield a better return in the shape of crops than would the whole if stripped bare. Contrary to the general opinion that the culture of forests induces an increase in rainfall, and that their destruction diminishes it, Mr. Henry Gannett argues in *Science* for January, 1888, from American meteorological data, that the influence of forests upon rainfall is too

slight to be of the least practical importance. As he expresses it, "Man has not yet invented a method of controlling rainfall." Mr. Gannett takes three areas of considerable magnitude—(1) the Prairie region of over 100,000 square miles, (2) Ohio, with 40,000 square miles, and (3) Southern New England, with 25,000 square miles, and compares the rainfall returns of each area for many years past. In the Prairie region thirty years ago there were no forests, but man has since encouraged the growth of trees, yet (says Mr. Gannett) "instead of an increase of rainfall being produced by the increase of arborescent vegetation, there has occurred from some cause an actual diminution." Again, as regards Ohio, its early settlers found it mainly a forest-covered region. It has been remorselessly cleared. Has its rainfall diminished? Mr. Gannett finds that it has diminished to a trifling amount, being 0·21 of an inch per annum less for the past quarter of a century than for the previous quarter. Lastly, in Southern New England, dense forests originally clothed the land, but in time these were almost entirely cleared away. "Deforesting in this case," says Mr. Gannett, "seems to be accompanied by a decided increase in rainfall."

MISCELLANEOUS.

Dr. Junker, the well-known African traveller, has been awarded the Karl Ritter Medal by the *Gesellschaft für Erdkunde* in Berlin.

Dr. Guillemard, author of the *Cruise of the Marchesa*, has been appointed **Lecturer in Geography** at the University of **Cambridge**. Dr. Guillemard is at present travelling in Cyprus, but is expected to return immediately and take up the duties connected with his new appointment.

The fifty-eighth Annual Meeting of the **British Association** for the Advancement of Science will commence in Bath on Wednesday, 5th September, when the President, Sir Frederick J. Bramwell, D.C.L., F.R.S., M. Inst. C.E., will deliver an address. The different Sections will meet daily from 6th to 11th September.

The existence of the **Avocet Rock** in the Red Sea has now been placed beyond a doubt. About a year ago, the ships *Avocet* and *Teddington* struck and sank in a position where no danger had been previously reported, and search was immediately made by H.M.S. *Flying-Fish*, and, later, by H.M.S. *Sylvia*, and other vessels, but without result. The *Flying-Fish* sounded entirely in deep water, but the *Sylvia* found 28 fathoms. The officers of the latter ship constructed a chart showing all the soundings made by them, and this proved of great use in the successful survey of H.M.S. *Stork*. The rock was discovered by Lieutenant Gunn within 300 yards of the 28 fathoms previously noted. It is covered by 17 feet of water, and 6 fathoms were found very near it.

NEW BOOKS.

Appleton's Physical Geography, prepared on a New and Original Plan. New York: D. Appleton and Company, *not dated.* (Copyright, 1887.)

The publishers of this beautiful volume of 140 large quarto pages deserve to share the credit of its production with the ten specialists whose contributions make it quite unlike any other work of the kind. The list of joint authors and their qualifications is too long to give; yet the labours of Dr. Quackenbos, the

literary editor, have combined into a fluent narrative what might easily have been a scrappy piece of patchwork.

There are twelve main divisions, broken up into numerous sections and paragraphs, dealing successively with the subjects of Geographical Science, Mathematical Geography, the Structure of the Earth, the Relief of the Land (to which the term Physiography is restricted), the Waters of the Earth, the Atmosphere, Plant Life, Animal Life, the Human Family, Mineral Products, and finally, with the Geological History and Physical Geography of the United States. Each section bears the stamp of authority, and contains valuable references to special papers. The twenty-three large physical maps are accurate, and coloured with great taste. Although not rivalling the best German work, they are at least equal to any maps produced in Edinburgh or London, but injudicious juxtaposition of green and blue prevents the gradations of tint from being strikingly clear.

The illustrations in the text are numerous, well chosen, and beautifully executed, with the artistic style and perfect printing familiar in *éditions de luxe*, but unknown on this side of the Atlantic in school-books. Delicately-shaded relief maps of the continents are specially remarkable.

A reader accustomed to British ideas regarding self-praise is likely to be prejudiced unfavourably by the preface ; but, after carefully examining the matter and the manner of the main body of the work, we are quite of the author's opinion that it is unique, comprehensive in its scope, clear and logical in its development, accurate and up to date, and "as a progressive text-book, on a level with the present state of science, and in full harmony with the requirements of the age."

We wish for it a cordial welcome in educational circles in this country, where it need not fear competition, as, unfortunately, there is no indication of British publishers undertaking a piece of work of similar scope and originality. There are, however, several points that seem capable of improvement. Turning over the title-page, on the back of which the laudatory preface clings as if a little ashamed of itself, one plunges directly into the text with an abruptness recalling the shock of crossing the threshold of a lobbyless church. There should, at least, be a Table of Contents to prepare the way and point out the nature of what lies within. The main divisions, again, should be classed as chapters, and the sections numbered ; this is not done, and it is necessary to look over the whole book in order to find any particular subject—the Index, which fills up the last page, although a good one, being too fragmentary to be of much service. One of the authors is a gem expert, and his subject is undoubtedly interesting ; but to devote three pages to precious stones, and only quarter of a page to iron seems unscientific ; while, to give fifty per cent. more space to imitation jewels than to coal is positively outrageous. Ferrel's law is very skilfully presented as the basis of dynamic meteorology accounting for the direction of ocean currents and prevailing winds. Buys Ballots' law is not mentioned ; this is a pity, because, although empirical, it is simple, easily remembered, and serves as a capital mnemonic. The treatment of the cause of tides is original, and particularly happy. The only positive blunder we have noticed is the trifling reduction of the height of Ben Nevis to 4,368 feet. MacCulloch's ancient error that the whirlpool of Corryvreckan is caused by a pyramidal rock in the channel is also perpetuated. Appleton's ten-authored *Physical Geography*, in spite of the want of balance, which may be corrected in a new edition, is altogether a step of the right kind in the direction of rational teaching in this science.

Die Verteilung der Bodenständigen Bevölkerung im Rheinischen Deutschland im Jahre 1820. Ein Beitrag zur Methodik der Dichtigkeitskarten und zur Anthropogeographie des südwestlichen und westlichen Deutschland. Karte im Massstab 1 : 1,000,000, und Text. Von Hektor Sprecher von Bernegg. Göttingen, Druck der Univ.-Buchdruckerei von E. A. Huth, 1887. Pp. iv. and 98.

In this monograph—a dissertation for the degree of Ph.D. at the University of Göttingen—the author furnishes a study in that branch of scientific geography which may be termed the methodology of map-making. The object he has had before him has been to illustrate (or rather to represent) cartographically the relations which obtain between the density of the population in a region and the various causes, local as well as general, on which it depends. As the basis of his method of procedure, Herr Sprecher von Bernegg takes the topographical maps of the region specially selected for investigation, and then arranges the population in groups according to the results of his study of the causational factors which enter into the determination of the relative local densities. Amongst these factors which define the limits, periphery, and extent of his various density groups, the principal are the situations of the dwelling-houses, the climate, the contour and physical features of the surface, the properties and degree of fertility of the soil, the cultivation pursued, its nature and methods, together with the presence or absence of minerals, the extent of moorland, forest, orchard-ground, and the skill, intelligence, and industry of the inhabitants. For the purposes of classification he groups his densities according to a vicesimal scale, the first division embracing those areas which have less than twenty inhabitants to the square kilomètre (equivalent to about fifty-two to the square mile); the second, those which have from twenty to forty per square kilomètre; and the last, including all areas having more than 200 persons to the square kilomètre (= 520 to the square mile). The consequence of this method of treatment, on the topographical basis, is that the map is parcelled out into a multitude of differently-shaped patches; and, as the colours used do not blend harmoniously, the result is anything but pleasing to the eye. In fact, the coloration is decidedly the reverse of praiseworthy. The map is of course the *raison d'être* of the work, the text being merely intended to explicate it and illustrate it. Into the reasons which led the author to choose the Rhine-lands and adjoining countries, and to select the particular period, the year 1820, we have not space to enter. The work bears abundant evidences not only of laborious research, but of patient and painstaking labour; yet the question occurs to us whether the game was worth the candle,—to go through such an amount of intellectual toil for the purpose of illustrating a theory of cartography which obviously has, owing to the changes that have taken place in social and economic relations, less pertinency now than it had seventy years ago. We should like to see Herr Sprecher von Bernegg devote his powers of research and industry to more vital questions of geography; for, with a little cultivation of the graces of style, we doubt not he could produce something much more worthy of himself than even the monograph before us.

The Land of the Pink Pearl, or Recollections of Life in the Bahamas. By L. D. Powles, late Circuit Justice in the Bahama Islands. Pp. xi+321. London: Sampson Low and Co., 1888. *Price* 10*s.* 6*d.*

Mr. Powles, from the nature of his official duties, had many opportunities, during his brief stay, of studying the geography, not only of the chief islands of

the Bahama group, but also of the lesser "cays," besides forming opinions as to their administration, and the manners and customs of their inhabitants. The title of the book is thus accounted for (p. 40) :—

"The *conch*, a mollusc with a handsome shell, is not only the commonest, but one of the most useful natural products of these islands. The shell is handsome enough to be bought largely by visitors ; it is used as a foundation for rough wharves and piers, as a kind of horn by means of which the fishing-vessels communicate with each other, and for fifty other purposes. The body of the creature is a valuable article of food, invaluable as a bait for fish, and, above all, therein are found 'pink pearls,' which sometimes are of enormous value."

Mr. Powles' term of residence was brought to a somewhat abrupt close, arising out of an appeal made against one of the decisions by which he sought to put down the cruelties practised by the white men towards their black servants. To this may, in some measure, be due his bitter protests against what he considers the maladministration of this part of our colonial possessions.

The book is written in a racy and instructive style, and contains, besides a map, an illustration showing the extraordinary formation of the *Ceiba*, or silk cotton-tree.

Longman's Junior School Geography. By GEORGE G. CHISHOLM, M.A., B.Sc. With thirty-one Maps. London : Longmans, Green, and Co., 1888. Pp. 96. *Price* 1*s.* 6*d.*

This is another step towards the rational teaching of geography. The system is based on the use of maps from the first, as an aid to comprehension on the scholar's part. Accordingly, exercises in map-drawing are introduced throughout, and the process is explained to the learner in four columns of letterpress, and to the teacher in a preface of somewhat disproportionate length. The maps, which are printed in black on white, are not pretty to look at ; but they fulfil their purpose. They are in pairs ; first a physical map, with the meridians and parallels drawn as straight lines, the coast-line strongly marked and generalised to show only the main capes and bays, and little else is shown than the chief mountains, rivers, and towns. This map is intended to be copied by the children, first to the same, afterwards to different, scales. The second member of each pair is intended for reference only, and is constructed on the ordinary projection, with due regard to outline. It is shaded to show density of population, in six tints, or rather six different hatchings ; the names of the chief products of each region are printed on the map, in type varying in size according to the commercial importance of the commodity. It might have been of service if Mr. Chisholm had recommended the scholars to take a tracing of the population maps, and paint their copy with successively darker shades of colour. The exercise would be a good one, and the resulting map, if well done, would be more effective and appeal more instantaneously to the eye than that in the book. The text of the book, which is printed in double column to suit the quarto page, is based upon these maps, and makes constant reference to them. In substance and arrangement it is that of Mr. Chisholm's larger *School Geography*, but the descriptions are simplified as well as reduced to suit the less advanced readers. The great difficulty in writing an elementary book on any branch of science is not what to put in, but what to omit without lessening the general effect. We are of opinion that the omissions here are extremely judicious. There is a pleasing absence of statistics ; only a few numbers are impressed on the mind to serve as units for future comparison, such as 120,000 square miles in estimating the area of countries, and 4,400 feet in the height of mountains.

Attention is given mainly to the physical features and natural productions of the countries of the world, chiefly those of the United Kingdom; the distribution of population is explained by these in all cases, and historical facts are mentioned in speaking of the chief towns and places of interest. The derivation of many of the place-names and product-names is given, and some valuable hints for pronunciation—one, presumably for the benefit of southern schoolmasters, "Pronounce O'bän (the *ban* as in *turban*)." Errors are remarkably scarce and harmless; one of those observed, indeed, will soon grow into a truth: "A few miles to the west of Edinburgh, where the Firth of Forth narrows, a railway-bridge has been built across that estuary."

En Océanie: Voyage autour du Monde en 365 jours, 1884-1885, par EDMOND COTTEAU. Paris: Hachette et Cie., 1888. Pp. 390.

The trip, which is racily described, led M. Cotteau from Marseilles through the Red Sea to the Dutch East Indies, and, after some wanderings there, to Australia and Tasmania, with short excursions into the interior; then on to New Caledonia, the New Hebrides, and Tahiti, and home by San Francisco, the Southern Pacific Railway, Mexico, and the West Indies to St. Nazaire. The author was quick to observe, is always generous in judgment, and his style, though superficial, is full of sparkle. He writes with no set purpose to serve, and so his track round the world is lighted up by a series of vivid inconsequent impressions, instead of being strung with selected observations moulded by foregone conclusions, as is too often the case in records of a year's travel. The forty-eight illustrations are admirable.

Rambles and Studies in Greece. By J. P. MAHAFFY. Third Edition, Revised and Enlarged. London: Macmillan and Co., 1887. *Price* 10*s.* 6*d.*

Few who have read Dr. Mahaffy's previous editions of this work will forget the charm of its lively style and picturesque descriptions. It has come into demand, we believe, as a traveller's hand-book "somewhat less didactic than the official guide-books," and we know few books so deserving to do so. No visitor to Greece should be without a copy of it; he will probably lose much of interest if he is, for Dr. Mahaffy throws the charm of ripe scholarship and accurate taste over all he describes.

This third edition is a reprint of the second, which had been carefully revised by the author early last year.

NEW ATLASES AND MAPS.

ATLASES.

BERGHAUS' PHYSIKALISCHER ATLAS. Fünfzehnte Lieferung. Inhalt: Nr. 3, Thätigkeit des Erdrinnern (Dr. H. BERGHAUS); Nr. 25, Ostindien und China (*Bathymetrical*), Dr. H. BERGHAUS; Nr. 71, Afrika um 1880 (*Ethnographical*), Dr. G. GERLAND. *Gotha: Justus Perthes*, 1888. *Price* 3 *M.*

HARTLEBEN'S VOLKS-ATLAS. Enthaltend 72 Karten in Einhundert Kartenseiten, mit Vollständigem Register. 1 Lieferung.

Wien, Pest, Leipzig: A. Hartleben's Verlag. Price 80 *Pf. each part.*

This is a popular atlas, without pretensions to scientific detail; the maps are openly drawn and clearly printed, and at the price of eightpence per part it is certainly very cheap.

THE ELEMENTARY SCHOOL ATLAS. By J. Bartholomew, F.R.G.S. 24 Maps designed to illustrate the principal text-books on Elementary Geography. *London: Macmillan and Co. Price* 1*s.*, *cloth.*

This atlas is really an *elementary* school atlas, and it is evident that its contents have been carefully considered, so that it might specially illustrate what is taught in elementary text-books. About a third of the maps are devoted to the general geographical features of the world, another third to the special geography of the British Isles, and the remaining third to general continental geography. The maps are clear and effective, and, with its substantial binding, the atlas is one of the cheapest published.

SOHR-BERGHAUS' HAND-ATLAS, über alle Theile der Erde im 100 Blättern Ausgeführt in dem kartograph. Institut der Verlagshandlung. Achte vermehrte und verbesserte Auflage 1888. 1. *Lieferung.*—Balkanhalbinsel—Afrika. 2. *Lieferung.*— Griechenland, Kronländer Oesterreich unter u. ob der Enns u. Salzburg. *Glogau: Carl Flemming. Price* 60 *Pf. each part.*

Judging from the first two parts, the "*Sohr-Berghaus*" promises to be one of the cheapest and best atlases published in Germany. The original atlas was edited by Dr. Heinrich Berghaus about forty years ago; but in this edition, so many of the old maps are replaced by new ones, and the old plates so thoroughly corrected, that although it cannot approach to the high standard of *Stieler*, yet, considering its cheapness, together with the completeness and high quality of the work, it really deserves a high place among cartographical publications.

MAPS.

EUROPE.

DEUTSCH-ÖSTERREICHISCH-RUSSISCHEN GRENZLÄNDER. — Massstab, 1 : 1,500,000. Mit Hervorhebung der Festungen und Unterscheidung der Eisenbahnen in ein- und zweigeleisige. Von C. Vogel. *Gotha: Justus Perthes. Price* 2 *M.*

IBERISCHEN HALBINSEL, Regenkarte der ——. Von Dr. G. Hellmann. *Berlin: Zeitschrift der Gesellschaft für Erdkunde. Nos.* 135, 136.

SCOTLAND. Bartholomew's Reduced Ordnance Survey. Scale, two miles to the inch. Coloured to show roads, railways, and height of land. *New Edition,* 1888.

Edinburgh District (North Berwick to Stirling, and Kirkcaldy to Peebles).

Glasgow District (Coatbridge to Ardrishaig, and Lochgoilhead to Irvine).

Edinburgh: A. and C. Black. Price in cloth case, 2*s.* 6*d.*

These sheets, as now issued in the new series of Mr. Bartholomew's Tourist's Maps, are very much improved both in appearance and usefulness. The old colouring into counties has been abandoned, and they are now coloured to show contours of height of land, the principal roads, and railways.

AFRICA.

AFRIKA. Die Fortschritte der Afrikaforschung 1788-1888. Von ALEXANDER SUPAN.

Tafel 1. 1788-1880 (10 Karten, Massstab, 1 : 80,000,000).
Tafel 2. 1888 (1 : 25,000,000), mit Nebenkarten.
Petermann's Mitteilungen, Jahrgang 1888, *Tafeln* 1 *u.* 2. *Gotha : Justus Perthes.*

Dr. Supan has here given a graphic chronology of the exploration of Africa during the last century, which period may almost be said to include all its discovery except the coast-line and Egypt. From his set of maps we see the gradual inroads of European pioneers year by year advancing further into the heart of Africa. The subject is one of special interest, and has been treated in a most thorough and effective manner.

DER UBANGI-UËLLE in seinem Mittellauf von den Songo-Stromschnellen bis 22° östl. v. Greenwich. Aufgenommen von Capitän van Gèle im Dampfer *En-Avant*, 21 Oktober 1887 bis 1 Januar 1888. Massstab, 1 : 1,500,000.
Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 9. *Gotha: Justus Perthes.*

MATABELE and Mashuna Countries, showing Mr. F. C. Selous' Routes. Constructed from his sketches ; collated with maps of other countries. Scale, 1 : 2,500,000. *Proceedings of the Royal Geographical Society, May* 1888.

AMERICA.

BRITISH COLUMBIA.—Map of a portion of Southern Interior of ——, embodying Explorations made in 1877, by G. M. Dawson, and by Amos Bowman in 1882-84. Scale, 1 : 506,800. Preliminary Edition, not yet geologically coloured December 1887. *Ottawa : Department of the Interior, Geological and Natural History Survey of Canada.*

VEREINIGTEN STAATEN UND VON CANADA, Karte der Volksdichte der ——. Auf Grund der Ergebnisse des X. Zensus (1880) u. unter Ausschluss der Orte über 10,000 Einwohner, entworfen von Dr. R. LÜDDECKE. Massstab, 1 : 7,500,000.
Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 8. *Gotha : Justus Perthes.*

OCEANIA.

CHATHAM ISLANDS, from Surveys by S. P. SMITH and JOHN ROBERTSON, 1868 to 1883. Scale, 1 mile to an inch.
Wellington : New Zealand Survey Office, November 1887. *Price* 5*s.*

NEW GUINEA. Map of part of British New Guinea, to illustrate the Explorations of W. R. CUTHBERTSON. Scale, 2 miles to an inch.
Melbourne : Proceedings of Royal Geographical Society of Australasia. Vol. v., *Part* II., 1887.

GENERAL.

DIE POST TERTIÄREN CONTINENTAL VERÄNDERUNGEN. Von H. HABENICHT.
Deutsche Rundschau für Geographie und Statistik. Wien: A. Hartleben.

Herr Habenicht here shows in six little sketch-maps the gradual changes and development of our world during the Post-Tertiary Period. Although, of course, extremely hypothetical, they must be the outcome of considerable geological study, and are certainly very interesting.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ON ATTEMPTS TO REACH THE OWEN STANLEY PEAK.

A Report to the Royal Scottish Geographical Society on the New Guinea Expedition.

By Henry O. Forbes, F.R.G.S., A.L.S.,
Hon. Fel. Geog. Soc., Lisbon.

As is known to the members of this Society, I left England in 1885 to attempt the exploration of the highest point, in British New Guinea, of the Owen Stanley range of mountains. The circumstances under which I left, and the vicissitudes and misadventures of the expedition before it reached the shores of New Guinea, have been from time to time recorded in this Magazine; but for the sake of the consecutiveness of the narrative, I shall recapitulate its history in a sentence or two.

Leaving London on the 1st of April 1885, I reached Batavia on the 8th of May. After a week's delay, I left for the island of Amboyna, in the Moluccas, a journey of three weeks' duration, to engage there my old head-man Lopes and three other of his kindred, to act as hunters, and to help in the supervision of the coolies from Java, who were to act as carriers. Returning to Batavia on the 29th June, I engaged twenty-five Bantamese coolies, and was ready on the 12th July to embark for Thursday Island, the nearest call-port of the Queensland line of steamers to my destination at Port Moresby, in New Guinea. In opposition to the authority of the Agent-General for Queensland, granted to me in London, I was, without reason, refused permission by the officers of the vessel, on her arrival at Batavia, to embark myself or my company. By an accident to the lighter proceeding with my baggage to the next steamer that arrived, the whole equipment of the expedition was lost. Though almost overwhelmed by this disaster, I continued my journey, but changed my destination to Brisbane. Here hope brightened under the hearty interest taken in the expedition by, and the liberal promises of support of, the late Sir Peter Scratchley, Her Majesty's first Special Commissioner

to the Protectorate, then on his way to Port Moresby. In Brisbane also, a vote made by the Geographical Society of Australasia was placed at my disposal, and helped in restoring the loss sustained at Batavia. Here also I engaged Mr. J. M. Hennessy to act as my second-in-charge, to whom I at once gave over the duty of refitting the expedition, according to my instructions, and of bringing across the Malays to Port Moresby in a steamer engaged for the purpose, while I proceeded in advance with the Special Commissioner to New Guinea, to arrange for their arrival later on.

On the 29th of August I landed from the *Governor Blackhall*, and found myself among, of course, a frizzly-headed race, but, to my surprise, of a light brown, instead of the sooty black colour, as I had expected to find from my knowledge of the inhabitants of MacLuer Inlet, in the north-west. Not less striking to us as new-comers was the unabashed nudity of the men, which is in very marked contrast to the modest demeanour of the women, who are becomingly and even prettily attired in a *rame* or grass petticoat, often of many colours, hanging from the waist to the knees.

There were at that time residing at Port Moresby few Europeans, except the missionaries, Messrs. Lawes and Chalmers. Like so many other visitors to these shores, I am deeply indebted to their kind hospitality for every comfort. For years the mission station has been placed at the disposal of all comers as a rest-house, where Mrs. Lawes dispensed, out of their often enough, in that unproductive land, scanty stores, with abounding generosity, the warmest-hearted hospitality; and to her tender care and nursing not a few visitors owe it that they have left its shores alive. A traveller's bungalow has now been erected by the Government.

On my arrival at Port Moresby I found H.M.S. *Lark*, in command of Lieut.-Commander Pullen, engaged in the survey of the harbour and adjoining coasts. With great kindness he gave me a tracing of his plottings, with a number of stations conveniently situated to serve as a base-line for the triangulation I intended to carry on along my route.

Port Moresby, lying in south latitude 9° 27′ 33″, and 147° 9′ 10″ east longitude, was discovered in 1873, by Captain Moresby in H.M.S. *Basilisk*. Having been soon after fixed on by the members of the London Missionary Society, the first white residents in the country, as their head-quarters, it became on this account the landing-place of all subsequent travellers and visitors to New Guinea. The beneficent labours and conciliatory attitude of these missionaries gradually reduced the at first by no means friendly bearing of the Motuans, as the tribe there is designated, into one of undoubted friendship, so that, when Her Majesty resolved to proclaim her protectorate over the south-eastern portion of the country, Port Moresby was naturally chosen as the chief seat of the Government. As has been described by Captain Moresby, it lies in a magnificent lake-like harbour, in which the largest vessels can anchor in safety. Otherwise, however, it is not so favourably situated for a capital as many other places on the coast, as all communication with the interior is extremely difficult. There is also in the dry season great scarcity of

good water; and except in the rainy monsoon, when the steep and closely encompassing eucalyptus-dotted hills are beautifully green, the whole landscape within reach of the eye is, as it was on our arrival in the month of September, brown, and as uninviting as well can be. At the north end of Fairfax Harbour, as the inner bay of the port is named, granite and quartz rocks occur; while the rocks that crop out along the shore, from the village of Hanuabada to the south-eastern headland of the harbour, are of pure silex.

On the 16th September Mr. Hennessy reached Port Moresby, in charge of the Malays and the baggage of the expedition, and on the 25th we started for the interior, which, but for the disaster at Batavia, might have been accomplished nearly two months earlier.

In this communication I intend to confine myself chiefly to a short account of the purely geographical features of the country, in explanation of the accompanying map, which has been plotted from the triangulation carried on during my two expeditions, leaving to a future occasion a discussion of the results arrived at in other branches of science when the observations have been elaborated.

The fixed stations on which the triangulation is based are Matahitu in the Huhunamo range, Mavaralolo, and Pullen's Hill in the coast ranges, Fanny Peak and Muninumu in the plain, with D'Urville Peak in the Astrolabe range.

Crossing the coast range by a saddle under Pullen's Hill, the path descends into an undulating park-like grassy plateau, very Australian in appearance, abounding with wallaby, and dotted with stunted eucalyptus trees, pandans, and dwarf cycads. Probably the yearly habit of the natives of burning the grass, during their hunting expeditions, has had an effect on the growth of the trees. Nearly all the cycads bear marks of having passed more than once through the fire, and the extraordinary vitality of this ancient order it is, probably, that has enabled them to withstand the vicissitudes of so many geological ages. The plateau is interspersed with numerous dome-shaped hills, shooting up abruptly in the Fanny range into singular rocky crags. In the wet season many rivulets meander through this plain; but in the dry season it is arid and parched, except by the margins of the Laroki River, which flows through its northern portion on its way to the sea in Redscar Bay. In crossing the plain, the eye has always before it the imposing breastwork of the precipitous crags of the Astrolabe range riven between Hombron Bluff and Warirata by the gorge of the Laroki River, which rises to all appearance as an impassable barrier across one's route. Surpassing Muninumu and Gorubada, a detached buttress of the range, about 1300 feet in height, the wall-foot of the Astrolabe is reached, where, on emerging from a dense thicket of trees, the guide points out the way as a narrow path that zigzags up its almost perpendicular face to the summit of the Warirata Cliffs. In this patch of forest the traveller first hears the curious and distinctive *wauk* of Raggi's Paradise bird, and the more melodious whistle-like call of the lovely King-bird. The Astrolabe range is composed of a very rough conglomerate of both rounded and angular fragments, striking in a general north-west and south-east direction, with

a gentle dip easterly, and exhibiting from Hombron Bluff to Mount Lilo the same inaccessible rampart. From Mount Lilo, where it abruptly turns off due south, it loses its imposing proportions, and dwindles as it approaches the sea. The highest eminence of this stately range I have named D'Urville Peak, in honour of the commander of the exploring vessel *Astrolabe*, from which the range derives its name. The conglomerate of which the range is built has been described as a volcanic breccia, but its even stratification over so wide an area, and the presence of water-worn pebbles and pot-stones, besides long, hollow rounded cavities, from which large tree-trunks have evidently decayed out, seem to indicate its sedimentary origin. Ascending by the footpath already indicated, we reach, at 2600 feet, the summit of this Cliff, which in some seasons is quite blue, from the flowers of the pretty gesneraceous Boea Lawesii. Standing in a clear day on the top of the Warirata Cliff, a magnificent view can be obtained of all the country between Tupiselei sea village, with the islands sleeping within the reef-barrier, round to Redscar Bay, and inland by the verdured sinuosities of the Laroki, to the rugged crags of Mount Yule, and the serrated summits of Mount Owen Stanley. From Warirata, descending along the edge of the deep chasm of the Laroki River, on the gradual dip eastward of the Astrolabe slope, and passing through the house-cluster of Sanasanagai, we reach Narianumu, the village of the chief Lohia Malaga, a man of weight and importance among the Koiari people, once a noted warrior and still a great hunter, and who, ever since the advent of the white man, has been one of his staunchest and most faithful friends. His village is dominated by the eternal boom of the Laroki Falls, rising up out of the gorge on whose brink his dwelling stands. The bed of the Laroki above the falls can be reached without great difficulty from Narianumu, and, standing on the edge of the vertical precipice, several hundreds of feet in height, over which the river precipitates itself, the vast amount of denudation that has taken place can be appreciated, when one realises that the range-face has been excavated all the way back from Hombron Bluff to the falls, and the *débris* carried away and dissipated. Over the whole eastern slope of the Astrolabe are scattered huge detached blocks of the conglomerate of which the range is composed, most of them standing erect with their lines of stratification consonant with those in the cliffs, and their edges and faces sharp and angular as if they had been riven from their attachments and transported hither, and not eroded to their present dimensions. From Narianumu, there is a gentle descent to the Narinoko, an Astrolabe-tributary of the Laroki, which runs west to its confluence at the Falls. Surmounting a low range of hills we reach the Laroki River, which comes round from the south-east. On continuing eastward beyond the Laroki as far as the Richardson range, though we have a good deal of eucalyptus, as we have all the way westwards to the coast, the country begins to assume a much less Australian aspect, and we encounter patches of thick tropical forests of giant trees with Malayan affinities, clothed with creepers and orchids. That it was more forest-clad at no distant date, would appear from the large grass-covered patches in which the Eucalyptus has established itself, inter-

spersed between the forest belts, the old sites, I doubt not, of cultivated fields purposely denuded of trees by the natives. A few miles beyond the Laroki, the path crosses a small tributary, which, if followed, leads through a defile in the Richardson range to a beautiful amphitheatre, within which is situated the village of Saminumu, the headquarters of the Sogeri tribe, whose chiefs, Yaroga, Goadi, and Biaierekin, were the most upright, kind, and faithful of friends to us during our long stay. Saminumu stands about 1500 feet above the sea, and is surrounded by steep hills attaining an altitude of 3000 feet. My first task on arriving there was to ascend the northern girdle of this amphitheatre to obtain, if possible, a view of the lie of the country towards Mount Owen Stanley. I found at the top an open rocky spot, with a good outlook northward; and from a careful study of the intervening country, I made out a practicable route, I believed, to the mountain, in a northerly direction; so that I decided to go no further eastward, but to plant near Saminumu my first depot. As frequent thunderstorms and heavy clouds hanging over the distant ranges by this time warned us that in the upland regions the rainy season had set in, I resolved to make my rest-camp here till the beginning of the dry season.

In a convention of the tribe, I was granted, with every demonstration of friendship and satisfaction, a grassy knoll on the slope of Mount Otomionumu facing their village, as a site on which to erect my camp. Here, within a few days after our arrival, with their willing aid, stood up, finished and fenced in, my miniature village of four or five substantial houses, on which the natives bestowed the name of the hill on which it stood. From October 1885 to May 1886 it was the centre whither flocked, with no little awe, to see the stranger and his wonderful belongings, tribes whose country no white man has yet seen, who were welcomed and scrutinised with a curiosity equal to their own by the white *Lohiabada*, or chief.

Although my Sogeri camp was situated at an elevation whose zoological features were well known, ornithological collecting and less assiduously the collecting of other groups of the animal kingdom, was daily prosecuted. Of the botanical denizens of the forest, especially of their fruits, we have hitherto had but very scanty knowledge; consequently, every possible hour was utilised in gathering specimens of the vegetation, which were examined with interest for foreshadowings of the type of the flora clothing the yet virgin Alpine summits of the ranges, and possible glimpses into the ancient history of this great island. Meteorological observations were taken with constant regularity, but neither the heat nor the rainfall was so great as I had expected. The greatest pluvial record on any one day was $3\frac{1}{2}$ inches, which fell in about $2\frac{1}{4}$ hours; the highest shade temperature of 100° F., and the lowest night register, *i.e.* 59° F., fell both in December, so that 41° F. was the extreme range of the thermometer during the six months from October. The maximum range recorded in any one day was 40° F.

The survey of the district was carried on by sextant measurements and plane-table observations. But of the fixed stations given me by Captain Pullen, only D'Urville Peak, on the Astrolabe, could be seen

from the accessible hills surrounding my Otomionumu camp. Then to find in so densely wooded a country a summit that commanded a view of two additional stations west of the range was extremely difficult. After long search I found that the peak bearing the name of Koikoko commanded a peep into the lower country below the Astrolabe by the wide gorge of the Laroki River. But before I could set up my instruments and fix its position it required the labour of twenty men for thirty days to clear it of forest. With Koikoko fixed, the base-line from D'Urville Peak to Koikoko enabled me to carry on a fairly accurate triangulation of the eastern side of the Astrolabe. With the loss of one of the angle books in the looting of my camp, which occurred at a later period, the survey of much of the country both to the south of Gawada and east of Meroka has been unfortunately lost, and is therefore still a blank in the map. The wide vale between the Astrolabe and the Richardson ranges might, but for the terrible cliffs of the former, which bar all convenient access, be available for agricultural or pastoral purposes, as the soil is in many places very rich. But east, north, and south of Richardson range, the eye can detect not a single speck of level land; sharp mountain ridges, separated by deep precipitous gorges, scoured by rapid streams full of cataracts and boulders, range behind each other in endless succession. Often these ridges are chopped into isolated blocks of fantastic shape, perpendicular, inaccessible, clothed with virgin forest. While there are vast unoccupied tracts in the neighbouring colonies where equally rich soil, under a better climate, and easier of access, is offered by Nature, disposed more on the horizontal and less on the vertical than in the interior of New Guinea, one may suppose that emigrants in search of new spheres for their energies will prefer to labour where the sweat of their brows must be less wantonly expended. The conglomerate of which the Astrolabe precipices are built up, appears everywhere in the Richardson range, and I observed no other rock till crossing the Crombie River, where soft black slates crop out. The detritus has as yet yielded no gold beyond the most infinitesimal specks.

My Sogeri camp, as I have said, was a waiting station, where, while passing the wet season, we were making ourselves familiar with the natives, and with their language and customs, for the more efficient accomplishment of the task we had set before ourselves. In December 1885, Sir Peter Scratchley, the Special Commissioner, who had given me a promise, in compliance with a despatch of Lord Derby in favour of the expedition, of substantial support, died, leaving the completion of much he had commenced in the hands of his successor. On him I thought I could confidently depend to implement the undertaking of his predecessor. At that time communication with Australia (where Mr. Douglas was residing) was very uncertain and irregular. I felt little uneasiness at his silence till the middle of March had come, the date when my preparations were nearly completed for advancing northwards, whither I had indeed begun to move part of my camp impedimenta. When not a single communication reached me by the beginning of April, I saw that it was impossible for me, unaided, to support the expedition throughout the

months required to carry on the investigations I had prepared myself for pursuing.

I decided, therefore, that it was possible to make a flying visit only to the summit, and to this end, taking with me ten Malays and thirty natives, and accompanied by Mr. Chalmers, whose great ambition it was also to ascend Mount Owen Stanley, I set out on the 12th of April from Otomionumu. By a path to the east of Koikoko, over Richardson's range, we descended by a long spur to an affluent of the Goldie—the Beccari River, a broad swift stream, about $4\frac{1}{2}$ feet deep, on whose banks I observed huge blocks of fine-grained basaltic rocks. From the river a very steep climb up a shoulder of the Justice Fry range brought us to a narrow gateway between towering walls of conglomerate, leading down to the valley of the Goldie. Descending on a knife-edge ridge of great steepness, and in some places almost perpendicular, we arrived at the village of Kaukari, which stands encompassed by rugged peaks and pinnacles.

To Kaukari I was accompanied by the Sogeri chiefs, Yaroga and Biaierekin, but this was the *Ultima Thule*, beyond which they would not venture, as the tribes of the Goldie valley were not their *wara-wara ;* that is, they were not united to them by ties of relationship or of amity. In order to proceed beyond this village, therefore, it was necessary for us to make friends with the tribes ahead, as they were rather hostilely disposed towards the white man. On our arrival we rendered ourselves, without great difficulty, *personæ gratissimæ* to Gomaradauri, the chief, who by various stratagems at length prevailed on some of the Ebe and Bereka people to visit our camp, and through them their chiefs were eventually induced, partly by curiosity, but mostly by cupidity, to adventure themselves amongst us. By means of tempting presents, conciliatory speeches, and long smokes of the peaceful pipe, we won our way to their affections. Then in the most cautious way, but unfortunately of necessity through the medium of double interpreters, we broached the subject of the "Great Mountain." Immediately there was a conspiracy of silence and of ignorance. Our most persistent efforts only elicited that they did not know the way; that there was a "great river" between us and it ; that beyond the river there were no people, and consequently no food to be got by the way ; and, above all, that the spirits that dwell on the mountain were the most terrible of beings : they delighted in cruelty, and would suffer no one who approached the mountain to escape alive. Nothing would induce them to go with us. We, however, determined to try the effect of a feast. We afforded them a whole day of gastronomic delight, without one disturbing reference to such uncanny subjects as the mountain, till late in the evening, when, in the good-humour of repletion, we coaxingly plied them again ; but with no better result—on no account would they promise to accompany us to the mountain itself. Would they guide us then to the Great Water ? If they would, we should be contented ; and they could have many tomahawks, and as much salt, tobacco, and red cloth as they liked. At last, on our solemnly undertaking that when the river was reached we should consider that their duty was accomplished, they gave their promise to conduct us. This was ten o'clock on Sunday night. After giving orders for everything to be ready for a move forward at daybreak, we retired to rest

in a very cheerful mood, feeling satisfied that if we once reached the unknown water we should probably find the way open itself up further. Imagine our disappointment when in the very early morning Yaroga, the Sogeri chief, pulled aside our tent flap to tell us that the Ebe and Bereka people had taken their silent departure in the night. It would have been useless to proceed to Ebe; we should have found no one in any of the villages, for our approach would be the signal for them to take to the bush or to some other village in fear of our displeasure at their breach of faith. Could I have counted on the resources promised to me, I should have gone forward with my own party, establishing depots a few miles ahead of each other, whither by repeated relays I could have advanced the stores and furniture of the camp, for the whole season was before me, and, as the crow flies, the distance was not more than 30 miles. But a rapid spurt could only be made by the aid of native carriers. Under the circumstances there was no alternative but to return. It was one of the bitterest disappointments of my life to have to face about for Sogeri again, and have to abandon the expedition for which so much money, and so many months of laborious preparation and instruction, had been spent; and after the Malays had not only gained the confidence and friendship, but acquired surprisingly well the language and ways of the Papuans, and when we had, with a party more carefully trained and equipped than any before us in New Guinea, every chance in our favour of accomplishing what we had undertaken.

Returning to Otomionumu, I gave my remaining time to the closing-in of the Sogeri-Meroka triangulation; and after packing up my collections, which were very bulky, I took my departure for Port Moresby and Australia on the 3d of May.

Soon after my arrival in Cooktown, I had a meeting with the recently-appointed Special Commissioner, at which the position of the expedition was fully discussed. Although he did not see his way to fulfil the promises given to the expedition by his predecessor, he expressed his great disappointment at its abandonment, and gave himself heartily to an effort to enable exploration to be resumed, if possible, at once. He offered £500—if this offer had only reached me at Sogeri, or even before my men had been returned to Java, the expedition need never have been abandoned—if the three Colonial Governments would contribute a like sum before the season was too advanced. Complimentary telegrams were received from some of these governments and from the Victorian Geographical Society, expressing a desire to aid; but it soon appeared that the funds could not be at my disposal before too late in the year to refit. Mr. Douglas therefore appointed me to the post of Government representative at Samarai (or Dinner Island), where (accompanied by Mrs. Forbes) I took up my quarters in the middle of June 1886, led by various promises to believe that, through colonial aid, I should be able to resume exploratory work in the next dry season. At Samarai I remained till the following March. Meanwhile, the Victorian Branch of the Royal Geographical Society of Australia had obtained from their Parliament for the purposes of exploration in the Owen Stanley range a vote of £1000. It was applied for, as the letters of the President and the statements in

the press led me to believe, on my behalf. In the end of March, therefore, relying on Baron von Mueller's correspondence and promises, I was relieved from my duties by Mr. Douglas, and with the munificent offer of a sum equal to that voted by the Victorian Parliament, from the Protectorate funds, I proceeded to Melbourne to confer with the Geographical Society, and make arrangements for the expedition. On my arrival in Sydney and in Melbourne I was surprised to find that grave dissatisfaction existed, unknown and uncommunicated to me, because I had not kept up sufficiently (from my extra-postal retreat) frequent communication with their Society. Yet on the abandonment of the expedition I had given in Queensland, before a large public meeting, an account of my procedure in New Guinea, a *verbatim* report of which was sent to the Australian as to all other interested Societies. At all events, the vote from the Victorian Parliament was asked for after I had returned to Australia, and while I was at the remote station of Samarai in an official capacity, and after all cause for this dissatisfaction had necessarily ceased to exist.

Returning to Port Moresby, I was reappointed by the Special Commissioner to an official post, and in the middle of September last, I was very gratified by receiving his instructions to make a geographical reconnaissance in the direction of Mount Owen Stanley. The Goldie valley had been penetrated a few years before for some distance, by a party of miners with horses, one of whom, happening to be in the government service, was attached to my party. I was instructed to ascend this valley as far as it was possible to take the quadrupeds, and from that point to extend, by survey, our geographical knowledge of the district as much as was possible in two months.

On the 1st of October I started, and, besides Gleeson the miner, my party consisted of George Belford, a bird-collector, who had had a long experience in New Guinea, and two Pacific islanders. From Port Moresby, steering a north-east course, and crossing the plain already described, we forded the Laroki River at its confluence with the Goldie, and pitched our first camp on the further side of the river. Making a short march on the following day, over a succession of low hills, we halted under Mount Seymour-Fort, which stands out as a rugged prominent landmark all the way from the coast. I purposely halted here in order to secure, before entering the Goldie valley, where the coast "fixes" would be lost sight of, a round of angles by which to establish it and Mount Keith—stations on which would centre much of the subsequent survey; for up to this point the sub-Astrolabe district presents few elevations over 300 feet above sea-level. From Mount Seymour-Fort, however, the country eastward and northward assumes that wonderfully shattered and disrupted character which I have described as prevailing beyond the Richardson range. From the hills near the camp, looking up the valley, Mount Alexander,[1] Mount Bates, and Mount Bowdler Sharpe (in Justice Fry range), are very prominent heights, and formed most valuable triangulation stations. As far up as our third camp, the Goldie is a wide

[1] Mount Alexander I have named in honour of W. Alexander, Esq., LL.D., of Aberdeen, the distinguished author of *Johnny Gibb of Gushetneuk*, and a warm supporter of the expedition.

and moderately rapid stream running in a valley, so contracted as to afford only a narrow passage along its banks; but above that it descends between rocky walls, broken by rapids, which necessitated us to diverge widely from our true course, and follow the rough broken and thickly-wooded ridges of the Annabel range, till on encountering the gorge of the Beccari river, our route was forced back again to the main valley at the junction of these two rivers. Here the banks being as unpracticable as before, we had to deviate again on the opposite side of the Beccari ravine, by a long steep spur, of many hours' climb, only to descend again an equally long slope, which was even more trying both to the horses and to ourselves than the ascent, and to the former more dangerous, as the wet and slippery ground was beset with roots and long noose-like palm lianes, in which they were constantly tripping. At the bottom of this slope we again reached the river, describing a long V-formed loop, having to "make good" only a few miles. From this spot for many miles upward, the mountain spurs abutting on the valley drop off in precipitous bluffs; as it was impossible to get out of the valley we had of necessity to pursue our journey in the boulder-beset bed of the river, crossing and recrossing to seize advantage of every shallow margin or sandy patch to ease our own and our horses' limbs. At length, where the river became too blocked by rapids and large deep pools for further safe advance, we found a sandy flat, enclosed in a double bend of the river, environed by grassy slopes with sufficient fodder for our eight horses for several weeks, and pitched our ninth camp on it on the 14th October, not having seen a single native all the way from the coast. In the deep pools of the river there was abundance of cat-fish and mullet, large quantities of which we caught with dynamite. The camp was, indeed, to a great extent, provisioned out of these convenient aquaria. In the river-bed, between our seventh and ninth camps, I observed the conglomerate strata, I have so often mentioned, lying unconformably on the same soft black slate that I saw in the Crombie River, while in the river detritus both were mingled with porphyritic and granitoid pebbles. Repeated washings of the sand, however, along its banks have yielded gold in no appreciable quantity. On ascending to the summit of the cliff-like banks of the river, I discovered to my surprise that our camp was within hail almost of Kaukari, the village where Mr. Chalmers and I were compelled the previous year to turn back. We were, therefore, again amongst the Ebe and Bereka people. Our arrival, however, did not become known to them till I sent a messenger to Ebe village, on the summit of Mount Salvadori, to announce the fact, whence quite a crowd followed him to the camp. I saluted them in their own fashion—by stroking them under the chin—and worked my way to their good-will by various gifts. Some of them were wearing beads I had distributed the year before at Kaukari, and by them I recalled to their memory the feast we had had together there. Remembering their superstitions about the "Great Mountain," I did not broach the subject of our journey thither, till I had accustomed them for some days to our pursuits, by inducing them to accompany me on my botanical and surveying visits to the surrounding hills. They accompanied me to Mount Bowdler Sharpe, a high rocky bluff of the

Justice Fry range, about 4000 feet in height, the only eminence within reach that commanded an extensive view of the country. From here the "Great Mountain" was pointed out to me, and I tried hard to draw from them how the road thither lay, but with no success. From that elevated spot one looked out as if on chaos: the mountains seemed scattered out anywhere and everywhere, without order, or system of ranges, or chains, but hedging anyhow every approach to Mount Owen Stanley. After long scrutiny, by picking my way, by eye, from peak to peak, I eventually selected a route northwards, as hopeful-like as any other, along which I noted and plotted the most distinctive heights, to serve as finger-posts. At length I casually divulged the fact that I was going to the "Great Mountain" to make "a writing" of it as I had done of Mount Bowdler Sharpe. Without suggesting that my auditors should accompany me, I displayed such a wealth of leather straps, red tape, knives, tobacco, and salt, as the reward of those who might go all the way with me, that I had abundance of applications for a place in the caravan. Yet on the day fixed for our departure, not a single Ebean put in an appearance, and I had, after waiting several days, to send to their homes a messenger to fetch them with gentle persuasion. So it was not till the 24th of October that I finally started, with high hopes of success, from camp 9, which I left in charge of "Jack" and "Cæsar," my two staunch Pacific Islanders.

Crossing from the camp to the western bank, and ascending through the village of Ebe to the crest of Mount Salvadori, I for the first time really faced toward the mountain of my destination, steering due north, a course from which we had persistently been forced by the nature of the country. A long steep descent, through a sea of tall grass, on which the sun beat so mercilessly that even the Papuan lads complained of the heat on their heads, though protected by dense mops of hair, led to the rock-walled bed of the Goldie River, whence an equally steep sun-baked and trying climb brought us to the village of Urava, where perforce, through the decision of our carriers, whose will had so often to be regarded as law, we pitched our tenth camp. The Uravans, who had come as far as the river to meet us, received us and the Ebeans in a very amicable spirit. During the evening there was a great coming and going among our porters, and at the hour of blanket-spreading, I remarked on their diminished numbers, but was told they had only gone to sleep in the neighbouring houses of their friends. In the morning, however, I discovered that of those who had started "to go all the way" with us, only two had not deserted. Fortunately the Urava people were good-natured and friendly, and we experienced little difficulty in making up our complement, after an exhibition of the "trade" they would receive for accompanying us. They, however, would only engage to take us to "where there were plenty of villages and food" beyond the "big water, but not to the mountain." From Urava forwards we had the kindly shade of the forest, which we fully appreciated in traversing the incessant rise and fall of the ridges and truncated spurs of the Savage Club Range,[1] which, to have accomplished under a blazing

[1] So named in recognition of the hearty reception given me by this well-known club, shortly after my return from New Guinea.

sun would have been almost beyond the endurance of my party. About two o'clock we attained, at about 4,500 feet, the watershed of the "big water," about which our curiosity had become so excited. At four o'clock en emerging from the scrub of an alluvial plateau after a long descent, we stood by the bank of the Naoro, and were somewhat disappointed to find it a muddy river, not exceeding 40 yards in breadth, and $5\frac{1}{2}$ feet in depth. Although 2000 feet above the level of the sea, it was running placidly, but swiftly, on a level sandy bed; but the sonorous boom of a cataract told us that at no great distance off it had begun its descent into lower country. Traversing a densely wooded level terrace on its northern side, we found ourselves in front of a very steep forest-clad rise. Up this we ascended for hours, and, reaching no villages before sundown, we were compelled to camp on the slope for the night. Next day, continuing the ascent, we reached the summit of Mount Archer, where a large crowd of the people of Uburukara were waiting our arrival, intimation of which I had sent a messenger forward to announce. A long and very rough and broken descent brought us to the village, consisting of a few wretchedly poor dwellings. Here our Urava carriers had fulfilled their contract, and we were now dependent on our new friends for our further advance, which I was very eager to continue. But we were the first white people they had ever seen, and being such objects of curiosity and interest that they wanted to show us off in their own village, so that, instead of moving forward, with the chance of offending them, I was compelled to spread my canvas in their village. As Owen Stanley Peak could not be more than a couple of days distant from Uburukara, I obtained a promise from the Urava people to wait our return from the mountain, when we should go home together. The Uburukarans, after some hesitation, agreed to pack us forward on, as I hoped, our last stage. The road was unusually rugged and broken, and traversed dense jungle, which precluded any view being obtained of the surrounding country. At ten o'clock, however, we reached the bare flat-topped hill of Ginianumu, and with boundless satisfaction, stood with only the easy descent to the Warumi between me and the long spur rising to the summit of Mount Owen Stanley, distant not more than a good day's climb.

The Owen Stanley Peak is a gigantic isolated pyramidal block standing in weird loneliness, detached from the main range, on its own base, culminating in several acuminate rugged central peaks and pinnacles, whence radiate sharp spurs with precipitous flanks, down whose gorges dash impetuous torrents, whose waters filled the air with a ceaseless moan, to join the Warumi and the Naoro. On the topmost of these—Huxley Pinnacle—I have bestowed the name of my honoured master in biology, who, from the deck of H.M.S. *Rattlesnake*, described and named the range in honour of her captain. Coutts Trotter Crag, Abercromby Peak, Sclater's Needle, Wharton Summit, and Mount Walker commemorate the writings, or the interest in New Guinea subjects, of these well-known authors and geographers, while Mount Tryon is named in remembrance of the secretary of the Royal Society of Queensland, which so warmly favoured the expedition.

Eager to proceed, I motioned the party, who had stacked the baggage

in a heap on the ground, to start forward towards the mountain, indicating with my finger the summit. The Uburukarans shook their heads and looked scared, and when, with an impatient gesture, I repeated the order, they began to slink away surreptitiously till I was left alone with only Ginianumu people about me. I tried persuasive tones without effect. They then depicted, in perfectly unmistakable pantomime, their terror of the mountain spirits, and the fearful atrocities of which these gnomes were capable. I tried for the rest of the day to tempt them with a display of coveted trade; I boasted of the wonderful powers of the white man, and displayed the capabilities of his arms. There was no result; they *would not* go to the mountain. To leave one of my party only in charge of the baggage and food supply, and myself ascend with the third man, would be taking on my shoulders too great a responsibility, where the attitude of the natives was so uncertain; while to have attempted to reach the summit alone would have been equally unwise as well as foolhardy. I decided, therefore, to return to the main camp, and, leaving there only one white man with the horses, of which the natives stood in the greatest dread (a guard sufficient, I thought, among a people so friendly as the Ebeans had shown themselves), to renew my attempt on the peak with the other white man and the two South Sea Islanders. Next morning the Ginianumu people packed us back within the territory of the Uburukarans, who seemed greatly relieved and satisfied at our return. We found that our Urava carriers, however, had, with the exception of three, taken "French-leave"; but, with a heartiness that rather surprised me, the Uburukarans offered to transport us back all the way to the Urava country, and we started at once, retraversing the route along which we had come till we reached the Naoro, at a spot named Madilo by them, where I pitched my fourteenth camp. Next morning, the 30th October, we struck camp very early, and when everything was ready for a start we experienced the uncertainty of the Papuan—which makes travel in New Guinea so very difficult, and which convinced me of the soundness of my plans in taking with me the year before my own Malay porters—every Uburukaran had made off, leaving only the three Urava natives to help us to transport the loads of eleven. About a mile or so from the camp the Naoro, contracted between narrow walls, dashes through its iron gates in a wild and deafening cataract, spanned by a fallen tree of gigantic proportions, across which the booted foot must tread warily. To prevent any benefit to the deserters from their perfidy, we threw into the cataract all the impedimenta and surplus stores we could not carry; and, setting a stout heart to the "stey brae," we reached Unarabaiva (a village of the Bereka people on a spur facing Urava), about four o'clock in the afternoon. Next morning, after a long and valuable series of angles had been secured from Origanumu, a village-topped peak close to Unarabaiva, we started for the main camp. It was while descending from this station to the Goldie River, on descrying my tent pitched in the distant village of Ebe, on Mount Salvadori, that I first realised the disaster to my camp (of which an account has recently been given in this Magazine),[1] which crushed the expedition amid such

[1] *Ante*, vol. iv. p. 138.

bitterness of disappointment as one feels whose grasp is frustrated as it clutches at a coveted goal. Of the loss sustained by the loot of the camp, the most irretrievable is that of the angle-books, containing much of the triangulation of the previous year and of part of the present journey.

Wherever it has been possible—and I have used every endeavour to discover them—I have bestowed on the natural features of the country their native appellations. Where it has been impossible to arrive at these with certainty, it has been necessary for the purposes of identification to apply English designations. Mr. Chalmers, who also visited the Sogeri district, has in some of his maps named several of the mountains; but I have been unable to satisfy myself of the identity of his localities, which I much regret, for I am of opinion that priority in the authorship of names should be as respected in geographical as in biological science. Mr. Chalmers' positions being fixed by prismatic compass may have something to do with the inaccuracy of those in the Sogeri region on his map, which ought to coincide, but do not, with many of those fixed by me. In many parts of New Guinea I have found by too frequent experience, that the compass is utterly unreliable from local attraction. At spots distant only a few feet from each other, I have found as great a difference of deviation as 20 to 25 degrees. I feel sure also that on examining the accompanying map, Mr. Chalmers will be satisfied that the point recorded by Rev. W. G. Lawes in the Proc. R. G. S. 1884, as reached by his colleague—*i.e.* 9° 2′ S. lat., 147° 24′ 30″ E. long.—must be inaccurate, as it would place him on the northern side of the Naoro, which had never been reached by a white man before my party had the good fortune to do so. The same regret attaches to my inability to fix the localities visited by Mr. Hunstein. I should have liked if possible to identify the Horse-Shoe Mountain, the designation given by that successful collector to the region whence he brought some of those magnificent birds of paradise, which he had the happy fortune to add to science. In Dr. Finsch's paper (*Ibis*, 1886, p. 238), the district is spoken of as being "in the heart of the Owen Stanley Mountains, between Mount Owen Stanley and Mount Obree." In the sketch-map accompanying that paper, it is placed between the sources of the Goldie and the Beccari rivers, yet somewhat further east than Mount Owen Stanley itself. I should be inclined to assign Hunstein's mountain to the place given to the Justice Fry or Savage Club ranges of my map—probably to the latter, were it not for its elevation of 2500 mètres, which much exceeds the altitude of the ranges delineated by me—certainly of Justice Fry range. The main (Owen Stanley) range, stands much further east than the head-waters of either the Beccari or the Goldie. Mr. Hunstein has probably good reasons for placing his Horse-Shoe Mountain so far east; and this easterly position leaves me no choice, unfortunately, but to omit it from the present map till its *site* has been more accurately plotted.

In closing this paper the pleasing duty remains of offering my grateful thanks for much material support and unfailing sympathetic encouragement to the Royal Geographical Society of London, and, in a very special manner, to the Royal Scottish Geographical Society, whose first, but

SKETCH MAP OF NEW GUINEA SHOWING AREA OF Mr FORBES MAP
NEW GUINEA
MAP OF
PORTION OF SOUTH-EAST
NEW GUINEA
Mount Owen Stanley
Owen Stanley Range
Mt Bellamy
Mt Hawley
Mt Alexander
Mt Wilson
Mt Hilton
Mt Douglas
Mt Hood
Mt Cotter
Mt Victoria
Mt Yule
Mt Obree
Mt Lamington
Mt Knutsford
Mt Lealdon
Mt Hubert
Mt Hall
Mt Hamilton
Mt Scratchley
Mt Suckling
Mt Lilley
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poorly successful, emissary it has been my high honour to be. To the British Association, to the Royal Society of Queensland, and to my native city of Aberdeen, I am indebted for their most hearty support. To the Hon. John Douglas and the Government of the New Guinea Protectorate for affording me, in an official capacity, an opportunity of continuing the work in which I had so long taken a deep interest, I render my best thanks. Lastly, to my friend Mr. H. H. Johnston, who, with such kind thoughtfulness, initiated through the columns of the *Times* a fund to repair the disaster sustained by the expedition through shipwreck at Batavia, my most cordial acknowledgments are here offered.

In a few words, then, as the results of the work accomplished in New Guinea, large additions have been made to botanical, and not inconsiderable to zoological, science, as well as contributions of the ethnology of many tribes; while an extensive series of meteorological observations have been tabulated; but in these departments the data for a final report have not yet been completely elaborated. A tract of country has been delineated for the first time, of which the map—for the plotting of which I am responsible, but for whose beautiful delineation the Society is, as heretofore, indebted to the cartographical skill of Messrs. Bartholomew—is now presented to the Society. I trust that in our contact with the natives also, in which we kept before us to uphold the honour, the philanthropy, and the magnanimity of the race we represented, may not be without good result: and that we may have, like the trickling tributaries of a great river that are individually lost to sight in its flood, contributed to the advantage and civilisation of a people that have claimed the affectionate interest of all who have lived longest amongst them, and known them best.

RECENT EXPLORATIONS IN THE TERRITORIES OF THE AFRICAN LAKES COMPANY.

(With a Map.)

By E. G. Ravenstein.[1]

A glance at the accompanying map of the country between Lakes Nyassa and Tanganyika reveals the fact that it embodies a large amount of information not to be found on existing maps. For this information we are almost exclusively indebted to officers of the African Lakes Company, whose reports have become available through the kindness and liberality of Mr. James Stevenson. It is not my intention to discuss, on the present occasion, the whole of the materials available for the delineation of the country lying between two of the great lakes of Eastern Equatorial Africa. I shall confine myself to a short notice of some of the more recent explorations.

[1] The map which accompanies this paper was constructed by Mr. E. G. Ravenstein for Mr. James Stevenson, who has liberally presented our Society with a sufficient number of copies for our Magazine.

But before I do this, it is incumbent upon me to offer a few remarks on the longitudes adopted by me. It is very much to be regretted that the whole of the observations made by so competent a surveyor as the late Mr. James Stewart should never have been published *in extenso*. We know, indeed, that his invaluable map of Lake Nyassa is based upon astronomical observations, but we do not know all the points at which these observations were made, and with reference to most of the work done by him since the publication of his Lake-map, we are almost in complete ignorance. On his map of 1883, Mr. Stewart places Karonga in 33° 50′ E. From a letter which I received from Mr. Stewart in 1881, I know that this and other longitudes were determined chronometrically, and are depended upon Blantyre being in long. 34° 56′ 30″ E. As Mr. O'Neill's most careful observations at Blantyre have shifted that place 7′ 24″ to the east (to 35° 3′ 54″ E.), all Mr. Stewart's chronometric observations have to be shifted to the same extent, and hence I have not hesitated in placing Karonga in long. 33° 57′ 24″ E.

As to the southern extremity of Lake Tanganyika, I still adhere to the position adopted for my map of Eastern Equatorial Africa, which is based upon Lieutenant Becker's longitude at Karema and Mr. Hore's survey of the lake. This places Pambete in long. 31° 8′ 30″ E. This is nearly the mean between Mr. J. Stewart's and Lieutenant Wissmann's determinations (31° 21′ 20″ and 30° 53′ E.).

The region traversed by Mr. James Stevenson's famous Lake-Junction Road has been partly delineated from recent materials, viz.:—

1. A sketch-map of the country between Karonga and Mwini Wanda, by Mr. W. O. M'Ewan, 1884; scale 1:292,000. This is an excellent map, showing also the author's and Mr. Bain's route to the Upper Loangwa.

2. A sketch of the road from Tanganyika to Nyassa, June 17 to July 12, 1884, by Mr. E. C. Hore. Mr. Hore spent 96½ hours on the march, and estimates the distance at 268 English miles. He gives no bearings.

3. MS. notes on the route from Lake Nyassa to the Tanganyika, by Mr. Fred. Moir. Total distance, 231 miles.

4. Lieut. Wissmann's map of his route from Lake Tanganyika to Lake Nyassa, May 12 to June 1, 1887. Scale, 1:927,554. Distance, as measured on the map, 260 English miles.

The combination of the above materials with Mr. J. Stewart's route-map presented considerable difficulties, but whatever errors there may remain as to details, I believe the general features of the country may be accepted as approximating the truth. The weakest points are to be looked for on the Upper Saisi and immediately to the west of Kirenji, where the position of Zoche (Msoki) is anything but certain. Not a single observation for latitude appears to have been made between Kirenji and the Tanganyika, although this country has been traversed very many times by European travellers.

Far more considerable are the additions which recent explorations by Mr. John W. Moir, Mr. Donald Munro, and Mr. W. O. M'Ewan enabled us to make in the country lying immediately to the west of the Upper Nyassa.

Mr. J. W. Moir's journey into the Loangwa valley, in 1879, has been laid down from a rough MS. map prepared by the traveller. Mr. Moir, in a note written on the face of his map in 1883, states that Mombera's is laid down from actual observations made at that place in lat. 11° 37′ S., and 30° 50′ 30″ E.; that Mr. Stewart and himself subsequently took lunars at the place, the result agreeing within a few miles. We have accepted Mr. Moir's latitude, but have slightly shifted the longitude in accordance with our itineraries.

Far more important in its results than this tentative expedition was a journey performed in 1885, by Mr. M'Ewan, from Bandawe, the Company's headquarters on the lakes, to Kambombo's, on the edge of the Loangwa valley, and thence northward to Kirenji. Mr. M'Ewan's observations are laid down on a map drawn on a scale of 1:912,000. Mr. M'Ewan's diary, giving distances, many bearings, seven latitudes, as also aneroid and temperature observations, which enabled me to compute the altitudes,[1] made it possible to lay down his route with considerable confidence. Mr. M'Ewan was joined at Mombera by Mr. Donald Munro, and a report which that gentleman addressed to Mr. Stevenson furnished valuable additional particulars.

Mr. M'Ewan left Bandawe on April 7, 1885, and, having been joined by Mr. Munro, started from Mombera's on April 14. The travellers encamped on that day at the foot of the Kabo Rock—a mass of granite covering an area of 160 by 80 yards, and rising to a height of 80 feet. Mount Parasinga, a prominent peak, was clearly visible, bearing 269°, and during the progress of the journey proved a valuable landmark.

On the 15th the road led through a level country and past several villages, the inhabitants of which were armed with bows and poisoned arrows. Crossing an open forest of tall trees, it emerged upon the Rukuru, close to where that river is impeded by cataracts. Another day's march brought the travellers to the edge of the plateau, whence they looked down upon a broken country, with low hills rising here and there. Going north they came past Chusu, an Atambuka village, in a narrow valley, and Chama's stockade, inhabited by Basenga, who were armed with bows and arrows, and whose women wore the "pelele," and at night, on the 19th, they camped close to Kambomba's town, which lies at the foot of the hills, immediately to the west of Mount Parasinga. There are between four and five hundred huts, and many sheep, but no cattle, as the tsetse abounds in the Loangwa valley. An Arab village is in the neighbourhood, and it appears that the Arabs go from here westward, past Bangweolo to Msiri's country (Katanga).

From Kambomba's northward, as far as Wiyembi, the route skirted the wooded range of hills, which bounds the broad Loangwa valley to the east. Most of the villages are inhabited by Basenga. It then climbed the hills to the village of the chief Chifungwi, a little thin man,

[1] Our altitude of Lake Nyassa (1570 feet) is based upon barometrical observations carried on at Livingstonia during the whole of 1876 and 1877. That of the Tanganyika (2670 feet) was computed by me from Captain Popelin's three months' barometrical observations at Karema. These are undoubtedly the most trustworthy altitudes for these two lakes obtained up to the present time.

with a small head, who wore anklets and bracelets of brass-wire and beads. His people are Wasingwa, but Mangamba and other villages belonging to him are inhabited by fugitives from Unyika, who fled from the dreaded Merere. Leaving behind them this hilly district, the travellers crossed the broad plain of Wanda, and arrived at Kirenji on April 28th. Thence a journey of three days took them to Karonga.

Mr. M'Ewan's estimate of the time spent on the march and the distance travelled is as follows:—

Mombera to Kambomba, . .	27 h. 6 min.	76·06 miles.
Kambomba to Kirenji, . . .	41 „ 22 „	112·59 „
Kirenji to Karonga, . . .	18 „ 14 „	54·17 „

This is at the rate of 2·8 miles an hour.

The western shore of Lake Nyassa is partly based upon information collected by Mr. Donald Munro during a land journey from Bandawe to Karonga (Aug. 18-30, 1884). Mr. Munro originally intended to follow Mr. Stewart's old route, but the dread of the Mangone compelled him to keep nearly throughout close to the lake. From a letter addressed by him to Mr. Stevenson we derive the following notes.

The Luweya forms a small delta, enclosing two swampy islands, fringed along its lake shore by sand-banks about 600 feet wide, which are thickly covered with native huts, Ngombo's people occupying the southern, and Makambiro the northern island. The southern arm of the river (Luweya-mufwa) leaves the main stream about 2 miles from the lake; it is 30 yards broad, 3 feet deep, and has a slow current. The dimensions of the main branch are similar, but its current is stronger. The northern arm (Chintechi) resembles a swamp rather than a river. The people who crowd the delta live in daily dread of the Mangone, against whom the swamps afford a certain measure of security. Their exhalations, on the other hand, are a source of much disease, and the many recently covered graves in the villages afford evidence of this.

Nkata is built upon a small peninsula, the neck of which is defended by a stockade.

The three rocky islands ("Chirwa," Chirupumbu, and another) in a broad bay to the north are crowded with huts, some of them upon piles. The adjoining mainland has a poor soil, notwithstanding which cassava is cultivated, and food appears to be plentiful. Leaving this bay, Mr. Munro climbed over steep hills, rising to a height of 1500 feet, and then returned to the lake, which he reached near a small bay dubiously called "Magwina" ("crocodile"). Wretched huts of fugitives cling to the hillsides further to the north.

Patowtow is a beautiful little harbour, extending about half a mile inland, and bounded by steep hills. It affords excellent shelter.

Having crossed the "Ruvu," which was 15 to 20 yards wide, and ankle-deep, Mr. Munro found himself in the densely-peopled district of Usisya, which extends for six or seven miles along the lake. The plain at the back of its villages is extensively cultivated. Bwana Hill, where Arabs trading in slaves and ivory, have a station, lies within this district. Thenceforth, as far as the Mrowi (Rukuru), villages are numerous.

Chipapa, the chief of Mrowi, extended a hearty welcome to his visitor. He is not, however, a favourite among his subjects, many of whom he has sold into slavery.

The Mrowi, known as Rukuru in the Mangone country, is described as being only 15 yards wide, 15 inches deep, and of slow current. Five miles to the north of it a river of similar dimensions, the Chiwetwi, enters the lake. The country hereabouts is well cultivated by people from the interior, who spend the rainy season until harvest time in temporary dwellings. The stream of hot water, already noticed by Mr. Stewart rises 300 yards to the north of the Chiwetwi.

When Mr. Munro had arrived about the middle of Florence Bay, he struck inland, and, having crossed many hills, came upon an extensive plateau covered with reeds and long grass, and infested with mosquitoes. Fulirwa, the chief's village, occupied a mound in the centre of this plain.

Ruali, the first village of Uchungu, stands upon the lake shore. Its houses and inhabitants contrast very favourably with what is to be seen among the Atonga to the south. Another day's march past a beautiful lakelet, the eastern bank of which was lined with reeds, and over a bare plain, where the ruined huts of Kiyuni spoke of a recent visit of the Mangone, brought Mr. Munro to the hospitable shelter of Karonga.

It only remains for me to give the results of Mr. M'Ewan's important astronomical observations:—

Mr. W. O. M'Ewan's Determinations of Latitudes.

1884.	May 12.	Inyondo (Nandoa), on the Kwakwa,	17° 56′ 45″ *
	,, 13.	Interra, on the Kwakwa,	17° 58′ 51″ *
	,, 14.	Ungurumbo (Mugorumbu), on the Kwakwa,	18° 2′ 27″ *
	,, 19. to June 20.	Maruru (A. L. Co's. Sta.),	18° 4′ 00″ * †
	Sept. 20.	Kamasa, camp on right bank,	9° 52′ 58″ †
	Nov. 12.	Lufira, camp on right bank,	9° 53′ 27″ †
	,, 25,30.	Karonga (Kasingula's),	9° 56′ 20″ †
	Dec. 18.	Mwini Kapoka,	9° 46′ 8″ †
1885.	April 19.	Kambomba's,	11° 5′ 37″ *
	,, 21.	Korowua,	10° 52′ 3″ *
	,, 21.	Chimbawanta,	10° 47′ 37″ *
	,, 22.	Mwini Chikonta,	10° 34′ 15″ *
	,, 24.	Manangma (Kanyu),	10° 30′ 32″ *
	,, 24.	Kachirika's,	10° 24′ 37″ †
	,, 26.	Mangamba,	10° 4′ 32″ †

* By meridian altitudes of the sun. † By circum-meridian altitudes of stars.

Mr. W. O. M'Ewan's Longitudes.

(These were determined chronometrically, and are referred to Karonga, assumed to lie in long. 33° 57′ 24″ E.)

1884.	Dec. 16.	Maramura,	[9° 55′ 30″ S.]	33° 46′ 7″ E.
	,, 16.	Kamasa,	9° 52′ 58″ S.	33° 42′ 45″
	,, 17.	Chiranga,	[9° 49′ 00″ S.]	33° 36′ 58″
	,, 18.	Mwini Kapoka,	9° 46′ 8″ S.	33° 27′ 52″
	,, 19.	Mwini Wanda (Chirengi),	[9° 43′ 15″ S.]	33° 23′ 45″

VARIATION OF THE COMPASS, determined by Mr. W. O. M'EWAN.

1884.	May.	Maruru (A. L. Co's. Sta.),	17° 32′ 21″ W.
	Sept.	Mwini Wanda (Chirengi),	13° 14′ 28″
	Nov.	Karonga,	14° 28′ 47″
1885.	Jan.	Mwini Wanda,	14° 25′ 38″
	April.	Bandawe,	15° 28′ 42″

LUKOMA: AN ISLAND IN LAKE NYASSA.

BY ARCHDEACON MAPLES, M.A., F.R.G.S.

MORE than a quarter of a century has passed away since Englishmen for the first time gazed on the waters of Lake Nyassa. So long ago indeed as the year 1854, the pioneer missionary, John Rebman, collected and sent to England some interesting information as to the existence and situation of the lake, as well as regarding some of the races dwelling on its shores. It was, however, reserved for Drs. Livingstone and Kirk to share the honour of being the first Europeans not only to reach Nyassa, but also to navigate its water. They, indeed, cannot be said to have discovered the whole of the lake, for, sailing northwards, they thought they saw the mountains closing in at the north end, at a point about 11 degrees south of the equator. According to their reckoning, therefore, it appeared to be about 220 miles long. Subsequently, a circumnavigation of its waters was made by Commander Young, who found it to extend some 130 miles beyond the point believed to be its extreme limit by its first discoverers. The twenty-seven years that have elapsed since Dr. Livingstone's first journey to the lake have been marked by many important discoveries in the lacustrine regions of Equatorial Africa; and no small progress has been made towards opening up these remote districts to Christianity and civilisation.

I do not, however, propose in the present paper to dwell very particularly on the work that is being done on the shores of the great lakes Victoria Nyanza, Tanganyika, or Nyassa by any of the various missionary agencies that are busy there. Even the work of the mission of which I am an unworthy labourer will be very briefly and incidentally noticed. My present object is to try and give a clear account of the natural features of the island in Lake Nyassa, where we, of the Universities' Mission to Central Africa, have recently formed a station and begun the work of evangelisation.

At the outset I may mention to my readers that Lake Nyassa is the southernmost of all the great Equatorial lakes of Africa, that it is about 350 miles in length, and that it has an average breadth of 40 miles, the middle part being broader than either of the ends. It lies nearly due north and south, and is for the most part very deep, shelving often very suddenly from the shore. Liable to heavy storms, and swept often by boisterous winds, high seas are of common occurrence, and waves are raised on its surface which would not discredit the briny Atlantic itself.

MAP
of the Country between
NYASSA AND TANGANYIKA
Largely based upon Unpublished Materials supplied by
JAMES STEVENSON, Esq.
Compiled by E. G. Ravenstein, F.R.G.S. 1888
TANGANYIKA
RIKWA
USAFA
TUNYIKA
WAPANGWA
WABENA
WAKUKWE
WAWEMBA
WABISA
WAMBEA
WAPINGWI
WAMBAKA
NYASSA

The waters of Nyassa, however, are innocent of brine, yet clear and blue as the Mediterranean. It has a coast-line which, though very rocky in places, is but little indented by deep bays and inlets. The only islands of any size which are both inhabited and cultivated are Lukoma, which I am about to describe, and its neighbour Chisumulu. A few rocky islets close to the shores of the lake, towards the north end, are the homes of a few refugees who dare not live on the mainland hard by for fear of the predatory tribe, the Gwangwara; but these poor fugitives build their houses on rocks only a few square yards in area, where there is neither space nor herbage even for their goats, and where there is not soil sufficient to allow of any cultivation. Other tree-clad rocky islets there are at the southern end of the lake, in some cases rising to a considerable height out of its waters, the homes of otters, crocodiles, hyraxes, and smaller animals; but on these no human being has fixed his dwelling-place.

With these reservations I shall be understood if I say that, practically, the only islands on Lake Nyassa are Lukoma and Chisumulu. These are situated abreast of one another and some 4 miles apart, Lukoma being about 5 miles from the eastern shores of the lake, and Chisumulu between 10 and 11. Of the two islands, Lukoma is much the larger, being perhaps three times the size of Chisumulu, with a population proportionately greater. In shape our island is rectangular, lying NE. and SW. It averages $4\frac{1}{2}$ miles long, by about $2\frac{1}{2}$ broad, and, roughly speaking, may be said to comprise an average of 12 square miles. The population, for reasons that will appear in the course of this paper, is unusually large, there being nearly 220 people to the square mile. Dr. Livingstone, although he passed up the lake to a latitude considerably north of Lukoma, sailing along the western shore, failed to discover the island. Probably it was entirely hidden from his view by Chisumulu, which he mentions in his *Zambesi and its Tributaries*, and which he places wrongly in the middle of the lake, exactly half-way from either shore.

The first traveller who landed on Lukoma was, I believe, the late Consul Elton, who with his fellow-voyagers walked all over it in 1877, and who, in a work published posthumously, entitled *The Lakes and Mountains of Eastern and Central Africa*, has recorded his impressions and made several notes of what he observed during his visit. Since that date the island has been occasionally visited by other travellers and missionaries, while two years ago it was fixed on as a favourable spot for missionary operations, by the Universities' Mission to Central Africa, and accordingly has become the centre of the Nyassa branch of its work.

The island lies equidistant from the northern and southern extremities of the lake. Exactly opposite it, on the eastern shore, are situated two very large towns of Nyassa people, ruled over, the one by a man named Chiteji, and the other by Mataka. All the inhabitants of the island acknowledge more or less the suzerainty of one or the other of these two men. Some few people indeed, who are immigrants from the further side of the lake, assert their independence of both, but as they

are for the most part quiet and inoffensive, it rarely becomes necessary for either of the chiefs in question to "show their teeth."

The lake is very wide near Lukoma, so that even from the island's western shores to the western side of the lake the distance cannot be less than 40 miles. Sailing in a direction WNW. from Lukoma the further shore is reached at Bandawe, the point where the "Livingstonia" Mission of the Free Church of Scotland has now its principal station, and of which Dr. Robert Laws is, and always has been, the very life and soul, supported as he is by a band of workers worthy of such a leader. As we look from our island across the lake to the mountains at the foot of which our Scottish friends are established, our view is obstructed by a high hill on Chisumulu, which effectually prevents all possibility of communication by means of signal-flashing with mirrors. The communication we do hold with them from time to time, is by means of the brave little steamer *Ilala*, which for nearly a dozen years has plied ceaselessly on the lake, and which now, very far from being on her last legs, if so unnautical an expression may be employed with regard to her, is the property of the African Lakes Company. The steamer belonging to our mission, named the *Charles Janson*, in memory of a saintly fellow-worker, who has been called to his rest, also crosses occasionally to Bandawe, and enables us to carry on regular communication with the outside world, by bringing up our letters and stores from the Shiré, which river they are placed on by the Lakes Company, who undertake the charge of them from Quilimane. In addition to these two steamers, there are a man-of-war's galley and a yawl. The former belongs to us, and the latter, originally presented by Harrow School to Mr. Cotterill, who accompanied Consul Elton's party ten years ago, has now passed into the hands of the Scottish missionaries at Bandawe. These four vessels make up the entire sum of the European craft at present afloat on the lake. A great deal of traffic is carried on by the natives in their own canoes or "dug-outs," which are propelled only by paddles, the use of the sail being either unknown or avoided by them. There are also five or six large dhows built after the usual East African type and used almost entirely in the nefarious slave traffic. These belong to one or another of the powerful Yao chiefs who have built their villages on the lake shores.

In a full account of Lukoma island, one will be expected to say something both as to its origin and as to that of its name. Treating of the second point first, I may mention that it is through Captain Elton's mistake that it has hitherto appeared as Dikomo in the maps. This name indeed it never bears, though as a variant of Lukoma, the pronunciation represented by the spelling Likoma is common enough. The name simply means "beautiful," "pleasant," or "desirable." Of the origin of the name different accounts are given. Some say it was called Lukoma because of its beautiful appearance, as it lies like some rich gem set in the deep blue waters of the lake. But others state, and I am constrained to say that I incline to their opinion, that the island obtained its name because of the safe asylum it affords from the incursions of marauding tribes, with all the rapine and bloodshed that follow in their wake. Natives, we know, have but little regard for scenery and

the beauties of nature. On the other hand, they have a very real dread of war, and are keenly alive to the advantages of a place where war seldom, if ever, approaches.

The origin of the island itself is of course a geological question, and one which is far too large for adequate discussion here. I can but drop a few hints to guide those whom the problem may interest, and who have the ability to pursue it further. An answer to the question can only be given in connection with the still larger question,—"What was the origin of Lake Nyassa?" And in the present state of our knowledge of the mountains on either side of the lake, and the lithological character of the rocks they comprise, we can do little more than sketch out a few broad outlines.

As far as is at present known, there are no traces of recent volcanic disturbances in the neighbourhood of Lake Nyassa, except indeed the remarkable series of lavas, tuffs, and agglomerates at the extreme north end, which form the so-called Konde Range and the Livingstone Mountains, and which Mr. Thomson, the traveller—no mean authority on such a subject—considers to have been in the main the product of one huge crater whose eruption took place in the later Carboniferous period. The origin of the lake must, I think, be traced to hypogene agencies, such as are to be found in the secular cooling and consequent contraction of the globe. These would give rise to the subsidence of the crust where it has had an excess of density, and in consequence of its upheaval along lines of weakness, such as we may suppose to exist beneath the mountains that now flank each side of the lake. The present basin of the lake no doubt was the seat of this subsidence, and thus the lake itself may be accounted for. Doubtless also the adjacent mountains were upheaved in two enormous and perhaps plateau-like masses of considerable breadth on either side of the lake in the first instance, and at a very remote geological period. Subsequently, subaërial influences affecting these masses have, by erosion and denudation, carved out valleys and depressions and ravines, and have thus given to the plateau an appearance of a series of mountain ranges. I am of opinion, however, that the practised eye of the geologist would not recognise these as (geologically speaking) true mountain ranges; while at the same time such an one would account for Lake Nyassa on the theory of a local subsidence of the earth's crust, consequent upon the contraction of the inner nucleus due to secular cooling, rather than on that of erosion due to subaërial influences, which, however, sufficiently explain the inequalities of level in the mountain plateau above. If this be a true account of the origin of the lake, then the island of Lukoma is to be regarded as an eminence which, when the subsidence of the district now forming its basin took place, was never submerged. An examination of the lithology of the rocks of the island, as well as of its surface soil, would seem to prove that at no time were they under water, since no traces of lacustrine deposits can be detected in any of them; nor are there any sedimentary rocks to be found, save only here and there a few shales, which are so rare and fragmentary as in themselves to be incapable of proving anything as to when, how, and (what is more important) *where* they were first deposited. Possibly (it must be conceded) the

waters of the lake may have stood at from 20 to 30 feet higher than they do at present, submerging a small portion of the present island where the land lies low, but I think there are signs that the waters never went beyond this limit. A somewhat similar account of Chisumulu island would have to be given, though since a considerable part of it is low ground and very fertile, a closer examination of its rocks would probably reveal traces of submergence over a far greater area. A remarkable feature in Chisumulu is a high dome-like hill which I have had, as yet, no opportunity of visiting, but which, from the vegetation that clothes it as well as from the crops raised on it, I should guess to be composed of some entirely different rock from those of Lukoma, which are entirely schistose, with here and there a few shales. The schist of Lukoma is very soft and decomposable, in parts micaceous and in parts hornblendic, yielding rapidly to the effects of weathering. It is subject especially to that form of decomposition and disintegration which is brought about by the expansion of the rock when the temperature is high, followed by sudden contraction owing to the fall of temperature at night, causing it to split and flake off, and rendering it tenfold more friable than it would be where the climate is not subject to such extremes of temperature.

The denudation of these soft schists caused by water is even more marked than the decomposition effected by the sudden changes of temperature. Each rainy season commits marked ravages upon their surfaces, and helps forward with amazing rapidity the waste and degradation of the rocks that are ever going on. Comparatively compact pieces of rock, laid bare by one season's rains in the bed of some runnel of water from the hills, are completely washed into coarse grit in the succeeding rainy season. No doubt the exceedingly heavy downpours that characterise the tropical rainfall are more powerful as erosive agents than the gentler and more moderate rain of the temperate zones. There are few very large blocks of schist or striking boulders—the hills for the most part presenting surfaces strewn completely over with comparatively small fragments of the decomposing rock. As the rain eats away at the softer parts of the rock, the while diminishing the bulk of the surface stones, these latter get dislodged and rolled down the steeper sides of some of the hills, breaking up into several pieces as they fall. Hence, as a rule, the larger stones or fragments of rock are to be found at the tops of the hills. Where the hills descend more abruptly into the lake, some very large blocks are found at the water's edge, the smaller *débris* having yielded long since to the power of the waves.

From what has now been said about the geological features of the island, it will cause no surprise to any one to hear that the soil is comparatively unproductive. Yet it would be a libel on it to describe it as wholly unfertile. Although there are but few parts of Lukoma where rice, millet, maize or other cereals, can be grown with any success, cassava flourishes everywhere, as also does a favourite kind of hard ground-nut. The oleaginous ground-nut is also cultivated, but will not grow so freely. The people live almost entirely on porridge (prepared from the flour of the cassava root) the above-mentioned nuts, and fish from the lake, which are often taken in large quantities and in considerable variety. In size

the fish of the lake range from a small species like a sprat, which is taken in shoals, and called "usipa," to a large kind of mud-fish often weighing four or five lbs. There is also a very large fish which is described as resembling the porpoise. This is never taken in the nets, though it sometimes gets into them, breaking and tearing them to pieces. On the whole, the fish of Lake Nyassa may be said to be superior in quality to most of the European fresh-water varieties.

It must be confessed that the island lacks a good supply of fine timber, though the large number of gigantic and grotesque baobabs which it boasts, together with some other kinds of trees of no mean proportions, prevent it appearing wholly given over to brush and scrub. Amongst smaller trees and bushes, however, there is an unusually great variety of fruit-bearers, including a wild custard apple (*Anona senegalensis*), a species allied to the *Landolphia* or india rubber vine, which bears a very favourite though very acid fruit, and a whole series of shrubs yielding different kinds of smaller fruits and edible berries. One of the latter resembles, both in taste and appearance, the whortleberries or "hurts" so common in the old country. It is needless to say that none of these have been brought under cultivation. A well-known poison-shrub—which yields a seed now in great request as a medicine in England, and likely, some think, to rival or surpass *digitalis* as a remedy in cases of certain affections of the heart—is also common. A plant called "tingu," whose stalks afford a strong fibre, is largely grown by the natives to supply them with string for their nets, the weaving of which forms the principal industry of the islanders.

There is little grass in Lukoma, yet large flocks of goats and no inconsiderable herds of oxen manage to thrive well, finding ample sustenance in the scrub and bushes and plants on which they browse. During the rains a plentiful crop of wild-flowers springs up, of which the most noticeable is perhaps a yellow one, not unlike the corn marigold. On the neighbouring island a much larger specimen, far more closely resembling the English flower, is found. A great number of the trees and bushes bear elegant flowers, and it is possible nearly all the year round to have at least a few flowers for purposes of decoration. There are, however, few that have a fragrant perfume, and I have failed to find even one kind of jasmine—a plant which is common in a very large tract of Equatorial Africa.

Turning now to the zoological features of Lukoma, we find it to possess none of the larger mammalia. The largest wild animals are monkeys, belonging to the sub-family of the *Cynopithecinæ*, of the genus *Cercopithecus*, which I believe to be represented by only one species. The interesting little animal known as the "galago," which is peculiar to the African continent, and which enjoys a very wide distribution therein, with a large number of differing species, abounds in Lukoma. There may be two species common to the island, both of which are very small. This little animal, my readers will doubtless be aware, must not be confused with the lemur, or so-called "Madagascar cat," although its affinities with that animal are so close as to allow of its being placed in a sub-family of the order *Lemuridæ*. The "coney" of Scripture, the hyrax, is

everywhere, true to its description, "making its home in the rocks." Otters abound about the lake shores, also crocodiles, and another large saurian whose skin is in great request for drums. Wild cats roam about stealthily in the wilder parts of the island, and snakes in considerable variety, many of them deadly, are unfortunately only too common. A huge python, though seldom seen, is certainly an inhabitant of the island. Water tortoises, which are of no great size, frequent the shallow parts of the lake close to its shores.

Amongst the birds, the most conspicuous are the great fish-eagle, a kind of diver, several species of hornbill, the ubiquitous crow, and a large hawk. Smaller kinds are, a remarkably beautiful kingfisher, two kinds of dove, a swift, and what must be, I think, a whydah finch. A great number of smaller birds, which I am not able to identify, are common in the island. With regard to domestic animals, I may mention that a large number of a very poor kind of dog, like the pariah dog of so many Eastern countries, are kept, and also cats—these last being remarkable for being always jet black, although the wild cat of the country is an unusually well-marked tabby. Every village has its flocks of goats, and there are about one hundred head of cattle, distributed through two or three herds. Fowls and pigeons are bred in abundance.

Having glanced at the geology, zoology, and flora of Lukoma, it is now time to speak of its present inhabitants.

Savage Africa has little or no history. Where people have no culture whatever, there can be no written record of their past. Where also they do not build in stone or brick, or any more durable material than reeds, and wood, and grass; and where even the use of metals is confined to the forging of spears, arrows, and hoes, little can be expected in the way of an archæological record. Tradition, vague and obscure in the extreme, is all that we have to fall back upon; and this can hardly be trusted for more than half a century of past time. Thus, in asking how long the island has been inhabited, we have little to guide us to an answer beyond our own wits and reason. It is highly probable, I should say, that owing to its natural advantages it has never been long uninhabited since this part of Africa first received its population, and when that was, no man living has data enough to allow of his making even a conjecture. As has already been said, its population amounts to about 2,500. Perhaps from one quarter to a third of the people belong to a tribe on the western shore known as the Wankomanga. The rest are all "Nyassas" or "Wanyanja," and are of the same tribe which is found on both sides of the lake in very great numbers. Some of their largest towns lie between the latitude of Lukoma, and one degree to the south of it. Others are found on the eastern side of the lake, and at its southern end. The eastern limit of the Nyassa people is bounded by the country of the Yaos or Ajawa, while to the west of those who live on the further side of the lake, are found the Wabisa and many others. At the extreme north end there are a few people who speak the Nyassa tongue, although a very little to the north of Lukoma such tribes as the Wanindi and Wakinga take the place of the Nyassa tribe, strictly so called.

The name "Nyanja," or "Nyassa," simply means a large piece of

water; or, as we should say, a "lake," or "sea." It is impossible to determine at present the etymology of the word, though I have no hesitation in saying that Rebman's derivation "Ni-aucha" (love me) must be rejected altogether as fanciful and absurd. It has already been pointed out that the inhabitants of the island are distributed through a number of villages independent of each other, but all more or less under the rule of two powerful chiefs on the mainland opposite; each village having also its head-man, who exercises a sort of minor control over the rest of the villagers, and who is the referee and judge in disputes, or "milander" as they are called. On the whole, the islanders may be said to be a peaceable people among themselves, rarely fighting the one village against the other. On the other hand, petty quarrels between one man and another are common enough, and there is no real principle of unity to bind them together. Society properly so called is a thing yet to come, but come it will as Christianity slowly but surely sows in the hearts of these people the seeds of true civilisation, and points them to the only principles which can build up true social life, and give them a bond of unity.

The main business of the islanders is net-making and fishing. At one or another of these occupations they may nearly always be found employed. If they are not twisting fibre into string for the nets, they are making the nets themselves, or mending them, or casting them. These nets are often very large, and are shared by several families; so that every "take" of fish is divided up amongst the different families owning the nets. Fish is far more plentiful during, and immediately after, the rainy season, though one favourite kind of small fry is almost peculiar to the dry months. Tending the flocks and herds gives employment to some few men and to a larger number of boys.

During the whole of the rainy season, which lasts between four and five months, and for a considerable time after it is over, hoeing, planting, weeding, and agriculture generally occupy the chief part of each day for the women. At other times of the year, pot-making, beer-brewing, and various other odd pieces of labour fill out her day for the housewife, who has besides to keep the house clean, prepare and pound the meal, and cook the food for the household. Tobacco is used largely by the Nyassas, not, however, in the form of snuff, and but very seldom chewed. It is smoked in "hubble-bubbles" made from gourds, fitted with a clay mouthpiece. Fathers, mothers, sons, and daughters, all smoke, even the very young children being encouraged to take their whiff when the pipe is passed round, so that it is common for many of them who are scarcely in their 'teens to be constant smokers. But tobacco is not by any means the worst form of stimulant in which they indulge. The islanders also are great drunkards, the evil of drink extending, as in the case of tobacco, to the very young children, who have "moa" (native beer) given to them, even before they are properly weaned. Hence, quite young boys and girls have nearly always a strong taste for the liquor, and very often indulge in the same excesses to which their elders are addicted. As yet, however, the island is happily free from the curse of the European liquor traffic. The native beer, though fairly strong, is the reverse of

volatile, and, being very thick, is food as well as drink, so that the effects of large quantities are rather in the direction of inducing a state of torpor and drowsiness in those who have become intoxicated. The brain probably does not become so excited as when the drunken fit has been caused by spirits.

The Nyassa language, or "Chinyanja," as we call it, which is the language of the island, is one of the prefix-pronominal languages belonging to the Bantu family of agglutinative tongues. It would seem to occupy a middle position between the dialects of the Zangian genus and those of the Zulu or southern branches. It is, as compared with some neighbouring languages, such as Yao or Makua, an easy tongue to acquire. Rebman, who more than thirty years ago compiled a dictionary of Chinyanja, was the first to point out its relation to the Swahili of the coast and the (so-called) Kaffir dialects, and to show that its affinities with these indicate its position with regard to them. It bears in its words so many signs of phonetic decay as compared with Zulu, that it is impossible not to regard it as an older tongue, or, to speak more correctly, an earlier offshoot from the original mother-tongue of the Bantu races than any of the Zulu or Kaffir varieties. A comparative philologist would, I feel assured, support this view of its age, and, if my memory does not deceive me, it has already been put forth by the man who has done more than any one else towards constructing a comparative grammar of this family of speech, Dr. Bleek. An interesting and lucid account of the main features of the Bantu family may be found in Professor Sayce's *Introduction to the Study of the Science of Language.* The whole of the New Testament is now translated and published in Chinyanja, besides a number of school-books, and a very fair, if not very comprehensive, grammar and vocabulary. The whole of this work has been done by the "Livingstonia" Mission. Dr. Laws, from whose pen most of the linguistic work emanates, has in type the pages of what, it is to be hoped, will prove a very full and copious Chinyanja lexicon. Members of the mission of the Established Church of Scotland at Blantyre have also given much attention to translations in the same language, and are beginning to publish tentative editions of versions of the Gospels and other books of the Bible. So far as I have been able to judge, I should say that Chinyanja has a greater tendency to develop dialectical differences than "Chiyao," its nearest neighbour, which, on the whole, is singularly free from them. A reason for this may be easily assigned. The Yao people are great travellers, while the Nyassas, comparatively speaking, are stay-at-homes. Words, therefore, with the Yaos do not get the same chance of becoming isolated or restricted to one village or small district. With the Nyassas they are more or less subject to such isolation; moreover, the lake itself, which stands in the way of constant communication, helps largely to bring about the dialectical variations of East and West Chinyanja.

It would require a separate paper to set forth fully the religious beliefs and superstitions of the people. Only a few leading features can be dwelt on here. Briefly, it may be said, the people know of God's existence, but it is to all outward appearance an almost wholly infructuous knowledge, leading them neither to worship, fear, nor obey Him. None

of them probably would deny His existence, or even His omniscience or omnipotence, though they neither think of Him as a God of love, nor as One to whom the affairs of men are a constant care. They look around on the world outside them, and at themselves, and say, "God made this, and us," but here, for the most part, they stop. A few occasions there are when they supplicate God's blessing on the crops, but only certain members of the community take part in those prayers, and I do not think it can be said to be a universal practice with them either to invoke or make propitiatory offerings to God. The subject is a very obscure one, and probably in course of time very much more than we at present know may be found out about it. I feel bound to add, however, that by far the greater number of the people show at the outset profound indifference as to the ultimate issues of life, and of the future state. Exceptions here and there, more especially amongst the younger people, there certainly are, and one and all are willing enough to listen to our preaching; but to say that, as a mass, they are eager to hear the good news of God would be, I must sadly confess, an entire perversion of the fact. As missionaries who have had a somewhat long experience of African natives, this causes us no surprise; and we know, happily, that it constitutes no real reason for being disheartened.

As might be expected, nearly every one lives in almost daily dread of witchcraft, and the belief in it that prevails is the cause often of shocking crimes. Few natural deaths, for instance, occur without its being said by some one that they have been caused by witchcraft. Nor does the matter rest here, for in a large number of cases resort is had to professed medicine-men, who proceed to "ombeza ula" (*Anglicè*, "to consult the oracle"). The "ula" is generally a bag, or skin, or gourd, containing various gruesome-looking articles, such as bones, teeth, pieces of wood, etc. This is shaken by the "doctor," who presently undertakes, by virtue of what it has taught him, to point out the people who bewitched the deceased parties. All believe in the truth of the "ula;" consequently no further questions are asked of the unfortunate creatures whom it is supposed to have pointed out. These are forthwith condemned to die, though sometimes their friends are able to buy them off, and thus save them from undergoing the sentence. More often, however, the terrible sentence is actually carried out. It is but two months since an appalling case of this kind happened within two miles of our mission-houses, when four wretched victims were burned alive without our hearing one word of it until the dreadful atrocity had been accomplished. Had we known what was going to be done, we could probably have rescued the four poor women from their cruel fate by buying them off with cloth and beads. The ramifications of witchcraft—trial by ordeal, and the like—run through the whole of the social life, such as it is, of these people, creating fear, and suspicion, and mistrust on all sides, breaking up families, severing friendships, and interfering, no one can tell how greatly, with the progress of civilisation and enlightenment.

The great event of the year with the Nyassas, as with so many of the savage tribes of Africa, is the dancing, feasting, and special rites that go on at the time when the "nkole" is held. Every year the young girls

from the various villages, from the ages of nine and ten to sixteen or seventeen, who have not previously undergone the ceremony, leave their homes, and for two or three months live in booths under the charge of several women, whose business it is to initiate them into all the mysteries of the "nkole," which consist mainly in certain mutilations which are unnatural and degrading in themselves, as well as being subversive of all ideas of decency. Many of the dances and songs at this "nkole" are of a highly immoral character, and the whole ceremony is a deplorable instance of a heathen custom utterly at variance with Christian principles and practice. A girl before she is initiated is called a "butu"; after she has been through the "nkole" she becomes a "mwali." No girl is exempt from these loathsome ceremonies, or ever marries till she has been through them. It will be obvious to any one that no young girls can take part in such scenes as these without becoming contaminated, if not wholly corrupted, by them. It is, alas! the time the young girls look forward to with the greatest eagerness, and look back upon with the greatest satisfaction, so terribly low are the ideas of morality in heathen Africa. The "nkole" is also held for boys, who live in booths far apart from the booths of the girls. In most tribes the "nkole" would be, in the case of the boys, the time when they undergo circumcision, but the Nyassa races are almost peculiar in this part of Africa in not practising this rite. Thus for the boys the "nkole" is only a time for dancing and feasting, and for them there are no bodily mutilations. As in the case of the "nkole" for girls, the songs are of a depraved character, and it is a time when all sense of decorum and modesty is abandoned, and the utmost licence prevails. The only way in which we can hope for the girls' "nkole" to be given up is when the children of those who are now children themselves, and whom we are gathering into the Church by baptism, shall be kept back by their Christian parents from undergoing these detestable rites. It must inevitably be a very long time before this degrading "nkole" will wholly give way before the advances of Christianity, for of all native customs that are deep-rooted and ingrained in the life of the people, this, perhaps the very worst of them, stands pre-eminent.

It is at the present time scarcely more than a year and a half since Lukoma was fixed on by the present Bishop of Central Africa as the most favourable spot that could be found as a centre for the work of the Universities' Mission in the Lake district. Consequently but few results of our work are as yet apparent. We have, however, from the first, maintained a boarding-school for boys, which has been subject to much fluctuation in the number of the scholars under instruction, though on the whole it has flourished well, and continues to do so. More recently a girls' school has been opened which also promises well. Not a few of the scholars have shown considerable aptitude in their studies, and already read and write fairly. Some of them, too, exhibit earnestness with regard to religion, and have come forward with a request for baptism. This desire has been met by admitting them as "catechumens" and giving them a course of definite preparation for the initiatory sacrament. In order to reach the grown-up people, we visit the villages in turn and preach to them there as opportunity is afforded us. On Sunday we have

a large open-air meeting for heathen hearers. A sermon on simple and elementary Bible truths is the chief feature of this meeting, at which we sometimes recite the Ten Commandments, and use prayers on behalf of those assembled. After the meeting is over, discussion is invited, and we talk with the people informally until they gradually disperse; after which we hold our own Christian services. From this meeting we have gathered sets of men and women who, being more earnest than others, have come forward for further instruction, and these we teach on other days of the week, in what are known as "hearers' classes."

Our steamer, the *Charles Janson*, starting as a rule every Monday and returning on Friday, makes a weekly trip along the eastern shores of the lake to a distance of about 80 miles, in order to enable one of our clergy to visit some seven or eight large coast villages which lie to the south of Lukoma. In these he holds hearers' classes, and preaches, and in one of them we have a flourishing school entirely maintained by one of our Zanzibar scholars. In this village lies buried one whose saintly character will be ever lovingly remembered by all who knew him, Charles Janson, in memory of whom the steamer bears its name. Regular instruction in religious truth is given daily to the men on board the steamer, and we are anxious that she should in every way keep up her position as a veritable *church ship*. She is a missionary and not a trader, and we want to help her to carry out her profession. Hence we even grudge the time that she has to go off her usual trip in order to carry up our stores and letters, and look upon this part of her work as an unavoidable necessity; though it may be confessed that when the good little ship heaves in sight, when we know our letters which we have been waiting for, it may be three or four months, are on board, we are not so ready to think of her long trip as one which has to be regretted!

I have now shown briefly how, as new arrivals at Lukoma, we are trying to break up the ground, and lay the foundations of the Christian Church. The island probably is a more healthy locality than we could have previously dared to hope to find it; and, as has been seen, many of the necessities of life, if not also some of its luxuries, are to be had for the buying. Milk, eggs, poultry, goats, and fish, we have in abundance. Add to these flour, sugar, coffee, and treacle, supplied by Buchanan Brothers, the enterprising missionary-colonists at Zomba, near Blantyre. Our buildings, it is true, are not as yet of a very permanent character; but, such as they are, they are convenient and commodious, though all the material, such as bamboos, poles, and grass, have to be fetched over in canoes from the mainland. We have planted a few of the fruit-trees that flourish on the coast, guavas, limes, and lemons: some young fig-trees also that have been planted this year show signs of taking kindly to the climate and soil. As yet, the tomato is the only vegetable that flourishes, though it should be added that little has as yet been done to prepare the soil for other seeds.

Enough has perhaps now been said to show that the island on Lake Nyassa deserves to be better known; and I trust that this brief account of Lukoma may have served to kindle some interest in it, in those of my readers who are not already familiar with its principal features, through an acquaintance with the operations of our Central African Mission.

NOTES ON THE DUTCH EAST INDIES, 1888.

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I.

I shall not attempt in this paper to give a full abstract of the official and other publications which have come into my hands, but only state the most important facts, and for minor details refer the reader, where it seems necessary, to the authorities. As it is well known that Java is the corner-stone of the Dutch Indian Empire, we need not wonder that, in the notes I have collected, comparatively little space has been given to the other islands.

I. Scientific Work lately done in the Dutch East Indies: Geographical Exploration.—The reader will probably be aware that the "Nederl. Aardrijkskundig Genootschap" (Dutch Geographical Society), at Amsterdam, has for some years past been vainly endeavouring to organise a Geographical-Geological Expedition for the exploration of the Dutch part of New Guinea. I think I may pass over the record of all the disappointments this project has met with. It is greatly to be hoped that the authors of it, whose efforts deserve every praise, will not be discouraged, but will still be willing to take up their very interesting scheme when at length the favourable opportunity does arise. Whilst the negotiations were still pending, a plan was brought forward to send an expedition to the Aaru, or the Obi group, but this project was not approved of in the Indies. The matter, however, is still under discussion, and, in the meantime, the Council of the Dutch Geographical Society have resolved to send an expedition to the Kei Islands, for the purpose of studying, in the first place, the topography, hydrography, and geology of these islands; but ethnography, zoology, and botany are not to be lost sight of (for the expedition, *v.* page 226, vol. iv. of this Magazine).

The Dutch Government have offered for each of the years 1888 and 1889, a subvention of fl. 10,000 (£833) for a scientific exploration of Sumbawa or Flores. This sum, it is proposed now to expend in connection with the expedition of Professor Dr. Max Weber, who is travelling at his own expense in the East Indies, and, perhaps, another Professor (of Geology, the name is not mentioned) will be of the party. In the Indies no scientific explorations have been made. The report on Dr. Hagen's journey to the lake of Tobah was published in the *Tijdschrift Bataviaasch Genootschap* (*Journal of the Batavian Society*), vol. xxxi.; and another report by Mr. S. W. Tromp, of a journey to the Highlands of Kutei, is still to be published.

The request of the "Imperial Museum of Natural History," and that of the "Imperial Museum for Ethnography" (both at Leyden), for a subvention—they wished to send an expedition to the East Indies—was refused by the Dutch Indian Government.

Magnetic and Meteorological Observations.—This work has steadily gone on, and vol. vii. of the observations has been published. By the end of 1887, 183 stations for the observation of rainfall were established (102 in Java and Madura, 35 in Sumatra, 6 in Billiton, Banka, and Riouw, 9 in Borneo, 17 in Celebes, 2 in Bali, 12 in other islands); the most eastern station was established on the Kei Islands. The seventh issue of rainfall observations appeared in 1887. The maxima of rainfall were observed at Madjalengka (Java), 5151 mm.; at Padang Pandjang (Sumatra), 4089 mm.; and at Amboina, 4078 mm. The minima were observed at Banjuwangi (Java), 1151 mm.; at Belidan (Sumatra, district Deli), 1592 mm.; and at Bima, 912 mm. At the Observatory a particular study was made of "The Influence of the Moon on the Clouds, and Magnetism of the Earth."

Surveys.[1]—For the survey of the Dutch Indies, three regular services are destined:—(*a*) The Military Service (*Topographische Dienst*); (*b*) The Hydrographical Service; (*c*) The Civil Service, Cadastre (*Kadaster*).

(*a*) The Military Service, at the head of which a lieutenant-colonel is placed, belongs to the War Department. It has three branches:—1. The (*Topographische Büreau*) central office at Batavia, where the maps are drawn in accordance with the field work (this office is responsible for the photography, lithography, etc.). 2. The triangulations and astronomical observations (two brigades). 3. Four brigades for the actual survey. There are in all about eighteen commissioned officers, some members of the civil service (of the rank of commissioned officer), a hundred non-commissioned officers, corporals, and privates (Europeans), and twenty-one natives (draughtsmen). Of late the economy which has characterised all the actions of the Government of the Dutch East Indies, has been extended to the Military Survey also, and consequently the number of brigades has diminished; formerly there were six. Had it not been for the great opposition encountered in the Netherlands, even the triangulation work in Sumatra would have been stopped before it really began.

As to the work done, it may be mentioned that the survey of Java is completely finished; the maps of the Residencies (1 : 100,000), after the method of Mr. Eckstein, are sold in the Netherlands at moderate prices —except those of Pasuruan, Besuki, Bantam, and the Preanger Regencies, which are still to come out; nevertheless copies of these have been published after other methods, and drawn on a smaller scale.[2] The triangulation and the survey of the West Coast of Sumatra are still in progress. To prepare the ground for a preliminary survey of the West Coast of Borneo, some astronomical observations have been made, and some survey work done.

(*b*) The Hydrographical Survey belongs to the Department of Marine at Batavia, where an office is established for the construction of charts; the officers at the "bureau" are in the civil service (though they belonged

[1] For particulars I refer to a paper I published in the *Zeitschrift für Wissenschaftliche Geographie*, 1882.

[2] A list of all the maps published and for sale may be seen in *Regeerings Almanak voor Nederlandsch-Indie* (*Government Almanac for the Dutch Indies*), 1888, Part ii., p. 508.

previously to H.D.M. navy). The survey is done by the active Marine, and a little steamer and two small craft are especially employed for this work. The astronomical observations, which are so very important for the Hydrographical Survey, are to be done by officers of the navy, who have to prepare for their task by special studies. But it is pitiable to read in the *Koloniale Verslagen* how those things are being done: now, we learn, an officer falls ill, and there is at the moment no substitute to take his place, because the man best fitted for these particular duties chances to be in the West Indies; then another, it is said, who would like to undertake the studies necessary for this particular service, cannot begin them, because there is at the Observatory no instrument fit for his purpose. Moreover, a proper hydrographical survey, as it ought to be, would be far beyond the means which the Netherlands can bestow on it, and therefore even those who know better must submit to circumstances which they cannot alter. Add to this that the "économie de bouts de chandelles," to which I alluded before, has contributed very much to make this service inferior to what it might be, considering the zeal and capacity of the officers, both those at Batavia and those doing work out at sea. It will be sufficient to make a comparison of the lists published in the *Government Almanac* for 1888 (*cf.* Part ii. p. 530-545) to see at once that they get through a fairly large amount of work. Of late the service has been carried on more particularly on the coast of Java and around the small islands near it.

(*c*) The Civil Service (*cadastre*) is confined to Java. The task of this Service is (1) to make maps of the lands belonging to the chief places, by which the valuation of the real estates can be made. (2.) To draw up maps of all estates which belong to private individuals (the greater part of the fields of the natives are held in common possession), if the owners have particular titles. (3.) To undertake the service of a regular *cadastre* in all chief places where no particular persons are appointed for this work. (4.) To continue the work of the Statistical Survey,[1] which was discontinued in 1880. It will at once be seen that there is still much to be done before the "Kadastrale Opmeting van Java" can be finished. For this work about 60 Europeans and 355 natives are employed.

From this hasty sketch one may see that much work still remains to be done, and that the existing maps of the Dutch Indies—I shall say a word or two on them afterwards—are only for the minor part based on regular surveys. With regard to this, the officers who are in want of a map of the country they are living in, are compelled to draw one as well as they can. In order that such work, if done, may not be lost, the Government issued an order a few years ago that all such maps should be sent to the central bureau of the military service. There they are examined, and after the chaff has been separated from the wheat, copies of them are made for practical use. Though these maps do not, of course, always reach the same level of perfection, much valuable work has been done, and, if space allowed, a long list of names could be quoted from the *Koloniale Verslagen* (Reports of the Government), and from the *Journal*

[1] *Cf.* my paper in *Zeitschrift für Wissenschaftliche Geographie*, 1882.

of the Geographical Society, of men who have made themselves well deserved by such work, which is not directly in their line.

But it is easy to see that, however much this is to be praised, the work done is, so to speak, only as a drop of water in the ocean, when compared to the whole area of the Dutch possessions.

The maps of Java only are based entirely on a survey, as it ought to be ; for some other islands there are general or particular surveys,[1] which, almost without exception, cover only small and limited areas, and from this fact conclusions as to the nature of the existing maps may be drawn. The best of them for a summary view, the *Atlas van Nederlandsch-Indie*, has been drawn up with skill and knowledge, but could not give more matter than its authorities furnished. By the way, it may be mentioned that the longitude and latitude of all places where astronomical observations have been made are put together in the *Government Almanac*, 1888, Part ii. p. 546-553. Some years ago a geodetic and astronomical service was working in Java not only to lay a foundation for the respective surveys, but also to collect the information necessary for the determination of the figure of the earth. After this work had been steadily prosecuted from 1865 till 1881, it occurred to the Government that the formation of Java was not suited for the purpose, and the field-work was discontinued. Since then a Professor at Utrecht, with some assistants, has been commissioned to finish the calculation. About the progress of the work, for which about £500 a year is spent, not much is said in the *Koloniale Verslagen ;* but since in 1881 it was stated that it might last four to eight years, one may infer that it will be finished ere long.

Turning to the work done by the MINING ENGINEERS, as far as it is useful to record it here, we must mention in the first place the Geological Survey of Java. It is known that in the great work of Dr. Franz Junghuhn certain shortcomings have been detected, and that the mining engineers were afterwards charged to collect facts wherewith to extend our knowledge of the geology of Java. Now the survey, at the head of which Dr. R. D. M. Verbeek, the well-known author of *Krakatoa*, is placed, is partially finished for the western part of Java, and it is believed that the survey in that part of the island, which has not yet been examined, may be done in a less exhaustive way. As an interesting fact, it may be stated that phonolites, which have never before been observed in the Indian Archipelago, have been found in the island of Bawean. Since the eruption of Krakatoa much attention has been given to the volcanoes, and whenever an eruption seems imminent, they are carefully examined. Most of the scientific results of the Mining Survey are published in the *Year-Book of Mining in the Dutch Indies* (*Jaarboek van het Mijnwezen in Nederlandsch-Indie*), and *Contributions to the Geology of the East Indies and Australia* (*Beiträge zur Geologie Ost-Indiens und Australiens*). This year, it is stated, they will probably be able to begin the drawing of a geological map of Java (1:200,000), whilst some complicated formations are to be drawn on a larger scale. Besides the operations in Java,

[1] For particulars see my paper in *Geographische Mitteilungen*, 1886, p. 114.

geological surveying was going on on the west coast of Borneo, the south and east coast of the same island, and in Menado (north part of Celebes). This work is being done, in the first place, for practical purposes. The sinking of artesian wells, which has been done in Java to a great extent, was continued.

Ancient History.—It is now almost five years since Professor Kern said, in his lecture *On the Influence of Arabian and Indian Culture on the Tribes of the Indian Archipelago*—"Our knowledge of that magnificent region (viz., the Dutch East Indies), on which Nature has so lavishly bestowed her bountiful gifts, has, in the last half of this century, increased in every department. It has been enriched by a number of facts, but, above all, has become more fundamental and more exact. Only in one sub-division does it seem, at least when superficially viewed, to be declining, viz., with respect to the ancient history, especially of Java. In the days of Raffles, and those who have copied him, they could, *e.g.*, tell exactly where and at what time the ancient empires of Java were founded, from which part of Hindustan the colonists came, what they had done," etc. And, he continues, "As time went on the blind confidence in the credibility of such authorities has given way to complete distrust, and now-a-days there is scarcely any one who has made a study of this subject but is fully convinced that no native tradition deserves to be fully trusted—that any narrative of events in the Archipelago is to be examined in the light of the evidence got from foreign sources, especially Chinese or Arabic. The chief thing we have to do is to collect the well-established facts, and, starting from them, endeavour to sketch the outlines of a history of the Archipelago."

And I may quote still another remark by Mr. Limburg Brouwer (*vide Tijdschrift van Nederlandsch-Indie*, 1878; *Eene Javaansche Inscriptie in England* (*A Javanese Inscription in England*). It runs as follows:—"The inscription of the Minto Stone does not, therefore, differ from other documents hitherto known to us, nor does it contain anything of the bombastic nonsense imputed to it by the would-be translation of Raffles, and on which Von Humboldt and Lassen have founded their theories as to the Javanese deities."

Respecting the studies to which Kern alludes, much has been done of late, but it is not easy to give a succinct review of the results, since what has been achieved till now consists for the most part of single facts without connection, and it would be unwise for one who is not *mediis in rebus* to attempt to construct any theory on them. In the first place, the *Notes* of Groeneveldt should be mentioned (*Notes on the Malay Archipelago and Malacca, compiled from Chinese Sources*, in *Verslagen Batavia'sch Genootschap*, xxxix.). They are reprinted in the *Miscellaneous Papers relating to Indo-China*, second series, and therefore are easily accessible to the reader, hence I will not dwell upon the contents. As to new discoveries I may state that, a few years ago, Mr. Kern deciphered some very interesting inscriptions found in Kuti, Borneo (*vide Verslagen en Mededeelingen der Kon. Akademie van Wetenschappen, Afdeeling Letterkunde*, xi. 2, 1882). Some ruins of temples hitherto unknown were discovered in

Jokjokerta, but by far the most important discovery of all is that the base of the great temple of Boro-Budur, as it now appears, is of later date than the rest of the building—that is, the real base, which is covered with sculptures and *inscriptions*, was surrounded by other stones up to the level of three mètres below the first gallery, to prevent the building from giving way. I have italicised the word "inscriptions" because we might expect to get from them, perhaps, some trustworthy explanation of the sculpture work. The Government have ordered those sculptures to be laid bare, and to be copied, without, however, endangering the magnificent ruins of the temple. The other inscriptions that until now have been deciphered have not shed much light on new subjects (as to one of them I shall still have to say a few words); but—and this is the principal drawback—there is so much work to be done, and there are comparatively so few scholars who have devoted themselves to do it, and what, perhaps, is still worse, they do not agree with each other either in the results obtained or as to the methods to be followed. In examining the papers dealing with this subject it will easily be seen how many authorities have succeeded each other, each proclaiming some new theory, but each in turn, after some time, precipitated from the pedestal his contemporaries had placed him on.

It is a circumstance worth noting, that a few years ago certain learned men, who had made a particular study of Indian languages, were appointed by the Indian Government to continue their work in the colonies. One of them, Dr. J. Brandes, who is busy studying the Old Javanese language, and all that is connected with it, and whose name is often met with in the valuable publications of the *Bataviaa'sch Genootschap*, has recently issued a paper (in the *Tijdschrift voor Indische Taal-, Land-, en Volkenkunde* xxxii. 2), in which he puts forward a few very remarkable suggestions. Though, of course, I cannot give here a full abstract of his interesting paper, and still less follow him so as to substantiate his conclusions, I think it may be worth while to state his opinions in outline, which I repeat, for the greater part, he does not consider as proved, but only as probable. Starting from a sentence (Jayapattra) from the Çaka year 849, he gives a general review of the impressions which he had derived from his study of the Old Javanese writings and manuscripts with reference to Old Javanese history.

Dr. Brandes suggests the idea that though the Hindoos had intercourse with Java perhaps since the beginning of the Christian era, it was not of much importance until about the Çaka year 700. But at the period just mentioned the natives of Java were much more cultivated than has hitherto been supposed, and the gifts for which they seem to be indebted to the Hindoos have been greatly over-estimated. The stream of Hindoo immigration was chiefly directed to the middle part of Java (which is still called Java *eo nomine*), and from there it spread over the other parts. Most probably it did not take root in Eastern Java till much later, for Dr. Brandes throws doubt upon the authenticity of the documents (published by Cohen Stuart, sub No. 2), in which Madjapahit is spoken of as existing in the middle of the ninth century.

One of the reasons which induced him to entertain the opinion just

pronounced may be stated ; it will be interesting to see with what sagacity he treats the question. That the Hindoos visited the Archipelago, is, he says, undoubtedly true. But the first question will be: At what time did they come? Now the inscriptions that have been found (here Dr. Brandes is on his own special ground) are very numerous from about the seventh century A.D., whereas before that time only very few are to be found ; from 719-1400 in the Çaka era there exists an almost uninterrupted series of inscriptions in Java proper. We are therefore justified in saying that about the year 700 the Hindoos came in much larger numbers than they did before. It would be important to find out for what reasons they came. Was it due to a spirit of inquiry? Were they urged by the desire of conquest? Did they really mean to found colonies, or did they come for commercial reasons?

It happens that about the same time Chinese reports cast some light upon the question. From them we learn that Java at that period was wealthy, had commercial intercourse with other countries, and was well governed. That the culture of the Javanese had by that time already attained to a point of development much more elevated than is generally supposed, Dr. Brandes tries to prove in another way.

When the Hindoos came, he says, the Javanese were acquainted with the *wayang* and the *gamelan*, they had native rhythms, they knew how to *batik*,[1] they understood the working of metals, they had coined money, they knew, comparatively speaking, a good deal about the art of navigation, and something about astronomy, they were acquainted with the practice of irrigating the fields on which they planted rice, and their institutions were altogether very well regulated. With regard to the last named, he refers especially to the institution of law ; it is interesting to learn that in the Çaka year 849 a law-suit was lost because the plaintiff failed to appear. It would be far beyond the scope of this paper to give a summary of the reasons by which Dr. Brandes seeks to establish his conclusions, which he derives for the most part from linguistic arguments; it will be sufficient to refer the reader to his paper.

Besides Dr. Brandes, a few other scholars are busy studying Eastern languages. Dr. Gunning is at work upon Javanese, whilst Dr. Neubronner van der Tunk continues his labours in Bali, and Dr. Jonker studies the Buginese and Mangkassar languages in Celebes. A map, illustrating the parts of Sumatra where the different languages are spoken (by Mr. K. F. Holle and Dr. Brandes) was issued with the *Koloniaal Verslag*, 1887, and similar maps are being drawn up for other parts of the Archipelago. Dr. van der Tunk's dictionary of the Balinese language will soon be (or is being) printed, and of Professor G. Schlegel's Dutch-Chinese dictionary two further issues have appeared.

It may be mentioned that last year Mr. C. M. Pleyte Wzn published in the *Bijdragen tot de Taal-, Land-, en Volkenkunde van Nederl.-Indie*, 5th series, vol. ii., a paper on the prehistoric stone weapons and implements found in the Indian Archipelago.

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[1] For the explanation of the words in italics, *vide* Raffles' *History of Java*.

The ETHNOGRAPHIC WORK relating to the Dutch Indies has, as is probably known, entered a new phase; till a short time ago we had before us a complete chaos of facts, which baffled even the specialist, who was thoroughly conversant with them, to frame easily a general view. Now we are especially indebted to Professor G. A. Wilken for more systematic work; several of his papers that have appeared in the *Bijdragen* mentioned above, and in the *Indische Gids*, etc., are extremely valuable, owing to his arrangement of the facts known to us, in a systematical and scientific way. But the accumulation of facts is very far from having been given up. Of late many valuable books have appeared, *e.g.*, Van den Berg's *Le Hadhramout et les Colonies Arabes dans l'Archipel Indien*, and (by the same) *De Inlandsche Rangen en Titels op Java en Madura*. Dr. Riedel's *De Sluik- en Kroeshaarige Rassen;* and many papers have been published in various reviews, too many to be enumerated here. But a good deal of really good work is now being done in the Dutch East Indies; copies of the excellent book of the late Dr. de Hollander have been sent to a number of the officers of the Government stationed in different countries, in order that they may look it over, and correct it and complete it. If this work is to be continued in the way in which it has begun, we may, in a not far distant future, be in possession of descriptions of the whole Archipelago, founded entirely on the autopsy of persons accustomed to deal with the natives.

A good deal of the work that has been done, and many subjects worth mentioning, I have not broached, being compelled to pass them over, because I wished to confine these notes to the provinces of geography and ethnography.

GEOGRAPHICAL NOTES.

ASIA.

Mesopotamia and Persia.—M. Henry Binder contributes a paper on this subject to the *Bulletin* (No. 5, 1887-88) of the Paris Commercial Geographical Society. It gives, on the whole, a fairly correct account of the present state of those regions, especially in respect of their means of communication so conspicuous by their absence. On this subject, however, the writer has nothing particularly new to say, and we cannot altogether agree with him in the opinion that the want of improvement is entirely, or even chiefly, due to the fatalism of the Mohammedan religion. Orientals, like Europeans, are often better and often worse than their creeds. This is particularly the case with the Persians, who have a marvellous knack of applying or ignoring the dogmas of their faith to suit their individual circumstances, tastes, and interests. Their bazaars are filled with the products of Lancashire and Yorkshire looms, of the ceremonial "uncleanness" and unfitness of which for the use of good Mussulmans no doubt is entertained. But not one in ten thousand refrains on that account from arraying himself in garbs of those unlawful materials. Instances of the kind might be multiplied indefinitely, so that we must seek for some other cause for the apparent stagnation. We say *apparent* advisedly. In Persia much has been done in the last twenty-five years. Telegraph lines stretch over

the country in all directions, those of the "Indo-European" system being models of strength and efficiency, as observed by M. Binder, who seems to have been much struck with the "imperturbable" stretches of iron poles far as the eye could reach. True, this was the work of the Indian Government and of an English company, but it was accomplished by means of conventions with the Persian Government, and it represents an important element of progress *in* the country. More recently a postal service was organised with the assistance of Austrian postal officials, which now works regularly and satisfactorily under native employés. Persia, at considerable expense to herself, is a member of the International Postal Union. Carriages have come into general use in Teheran, and a short railway of six or seven miles has been made thence to Shah-Abdul-Azim, a popular place of pilgrimage in the neighbourhood.

As for great "voies de communication" like railways, the country is far too poor to think of undertaking them at her own cost. If they are to be seriously taken in hand by means of foreign capital, questions of a political nature will at once arise. Here it is, and not in Mohammedan fatalism, that the causes of stagnation lie. Chief among the political difficulties is the necessity, which Persia believes herself to lie under, not to do anything displeasing to her powerful and not over-scrupulous neighbour. Now it so happens that railways, or even roads, to be of any real service to Persia, must start from the south, whence alone her path is open to the outer world by way of the Persian Gulf and Indian Ocean. But it is just this very opening up of communications from the south that Russia dislikes and opposes.

Turkey has much less excuse for her obstructive supineness. The great natural highway of the Tigris is all but barred against foreign vessels. Two (and only two) English river steamers are allowed by the Porte to navigate between Baghdad and Bussorah, a number utterly insufficient for even the existing trade, little as that trade is compared with what it might easily become. Here it is not a matter of expensive railways, onerous guarantees, and difficult international questions. All that is wanted is the removal of arbitrary restrictions.

The Engano Archipelago.—This island group, lying off the coast of Bencoolen, Sumatra, in the Indian Ocean, between 102° 7′ 41″ and 102° 23′ 3″ E. long., and between 5° 18′ and 5° 30′ 30″ S. lat., consists of the principal island Engano, and some six small uninhabited ones disposed around its shores. The area is 23 geographical square miles. The island of Engano proper has a population of 914, of whom 870 are indigenes. Its coast-line is very irregular, forming many capes and bays and creeks. The entire archipelago is surrounded by coral reefs, which at some points recede to a considerable distance from the shores, and upon which a heavy surf at all times beats. Good anchorage is however afforded inside the ring of reefs, which is broken at several places so as to admit even large ocean-going vessels, the safest and most commodious anchorage being on the north-west. The structural foundation of Engano is coral, which is overlain by a layer of tenacious red clay, intermingled in places with the sand of triturated shells. The main axis of the island lies from north-west to south-east, and averages about 600 feet in height. Many peaks, however, especially in the south and south-west, attain to 1000 or 1200 feet. Nowhere are there any districts of level ground of any noteworthy extent; even along the south coast the hills rise up sheer from the water's edge. The island is well watered with streams, most of which have their origin in springs at the northern foot of the hills. The three largest, which originate in this way, flow nearly parallel to each

other, at first north-east; then they curve round and reach the Indian Ocean, two on the north-west coast, and one on the north coast. Two of these are about 30 feet wide at their mouth, with a depth of 12 to 15 feet. Roads, in the proper sense of the term, do not exist on the island.

In spite of the infertile character of its soil, Engano possesses an abundance of species of the vegetable kingdom. First in importance among this class of natural productions come timber-trees, which yield wood suitable for house and boat-building purposes, and fibres for rope-making, bark for making clothing, leaves for roofing, etc. There are also various species of *Rhizophoræ* and *Gramineæ*, together with wild *pisangs* and tree-climbing plants. The principal cultivated trees met with in the fields and enclosures of the native Enganese are coco-nut palms. Besides these they grow the cassava, various varieties of pisang, sugar-cane, pine-apple, and certain East Indian fruits.

The island is likewise rich in animal life, particularly in the avian, reptilian, and insectal departments. None of the larger *Mammalia* are found, except wild hogs, which are hunted by the natives with dogs, and nets, and spears. Nets are also the means employed by them for the purpose of catching both birds and fish.

What little trade there is, is carried on by means of barter with Chinese, and with the natives of Bencoolen, Bantam, Batavia, and the Buginese, ropes, planks, and rottan being given in exchange for clothing, knives, implements for house and boat-building, mirrors, glass-beads, and tobacco. To the consumption of this last-named the entire population, of both sexes and all ages, are passionately addicted.

The origin of the Enganese is not known with certainty. According to the native legends they trace their descent from a Chinese source. They are of medium height, stoutly built, and of a reddish-brown colour, the women lighter than the men. Their hair is pitch black, glossy, and, in general, more or less curly. The eyes are set slightly oblique, the forehead is round, and the mouth large, with thin lips. The cheeks are large, the teeth white. Both men and women bore their ears, and wear in them objects of large size and considerable weight. On the whole, they are very ignorant, uncivilised, and timorous, excessively immoral and avaricious, yet at the same time hospitable, willing to help, and not averse to labour. Their religious conceptions are limited to the belief in good and evil spirits, whom they seek to propitiate by offerings, consisting of the different means of subsistence common to the people themselves. The land belonging to the settlements or villages, which is brought under cultivation, is held either in individual or in communal possession, for both systems exist side by side. Their houses are built of wooden planks, and are strictly confined within an enclosure of palings, some five feet high. The national weapon of the Enganese is a long lance or spear for throwing, though of late years it is becoming customary to carry the Buginese or Palambangese *parang*. Amongst the customs that mark the occurrence of birth, marriage, and death, it is interesting to note that the children belong to the mother, that is to say, the marriage relations are in principle matriarchal.

These particulars are extracted from a paper by Herr O. L. Helfrich, in *Tijdschrift v. h. Nederl. Aardrijksk. Genootschap* (2 ser. pt. v., sect. 1, No. 1), where also a map of the island group is printed.

AFRICA.

The "White Pasha."—With regard to the report that has come from Suakim that a "White Pasha" is making his way towards Khartum, it may be well (says

Dr. R. W. Felkin, in a letter to us) to explain how this rumour has probably originated. Twenty months ago a large caravan was fitted out at Roweyah by Jeddah traders to go to the south to buy slaves. The usual time occupied on this journey is about twenty months, so that the time when the first report of the White Pasha came to hand would correspond to that of the arrival of the traders at Suakim. The caravan went to the usual markets in the Bahr-el-Ghazal, but found them all closed and the country in the hands of the Negroes. The latter told the slave-dealers to go away, or the Great White Pasha (Emin) would be called from the south to drive them away. As they had never heard of Emin Pasha they were frightened, and returned empty-handed, spreading the above report in order to explain the failure of their mission. It should be borne in mind that we know of no one at Suakim just now who has any knowledge of the interior of the country, which accounts for the report of the White Pasha being Mr. Stanley obtaining ready credence.

Three New Expeditions for the Rescue of Mr. Stanley and Emin Pasha.—The doubt expressed on all hands as to the success of Mr. Stanley's expedition, and the total want of any news as to his whereabouts, has resulted in the projection of three new expeditions, with the object of ascertaining his fate and of carrying supplies to him and to Emin Pasha. The most important of these expeditions has been set on foot in Paris by the principal members of the former French section of the African International Association, who met at the beginning of this month and reconstituted their Association upon a new basis. They resolved to organise without delay an expedition to be sent to the assistance of Mr. Stanley and Emin Pasha, and, the necessary funds having been immediately subscribed, they determined to intrust the command to M. Charles Soller, who is said to be an accomplished traveller, with considerable experience of Western Africa, Marocco, and the Sahara. M. Soller has, we understand, arrrived in Paris, and commenced the organisation of the expedition.

The second expedition was originated by Captain Camperio, President of the African Society of Milan. It is intended that this expedition should be paid for by public subscription, and that a start should be made from Zanzibar. As the sum which Captain Camperio thinks necessary is only 40,000 lire (£1600), we cannot think that the expedition will be successful.

The third relief expedition has been proposed in Berlin, but with the exception of the statement that a prominent explorer is to head the caravan, no details as to scope or route have been allowed to transpire.

The Island of Orango.—The following account of a visit paid to this island by M. Marc Astrié, the Turkish Vice-Consul on the West Coast of Africa, is abridged from a narrative read by M. Baguet before the Royal Geographical Society of Antwerp, and reported in the second part of the twelfth volume of that Society's *Bulletin*, lately issued. The island lies in the Archipelago of Bissagos, which is situated to the West of Africa, opposite to the mouth of the Rio Grande. The principal islands of this group are Orango, Bissao, Formosa, Mauterra, Cavalho, and Bulama. The last-named has been for a long time occupied by the English, but was originally colonised by the Portuguese, under whom it was used as an entrepôt for the slave-trade. It produces rice, indigo, the coffee-plant, and the cotton-tree, besides delicious fruits and vegetables. It rears also cattle, and the sea around it abounds with fish. The climate, however, is very unwholesome for Europeans. It was from this island that M. Astrié sailed to explore Orango. His friend, the Consular agent, tried hard, but in vain, to dissuade

him, by representing that the island was governed by a Negro king, Caetano Umpané, who had treated with atrocious barbarity the crew of an Austrian vessel which had been wrecked on his shores. He took with him in his sloop only five men, and these were all people of colour. Landing on the island, which he reached in three days, he was at once conducted to the king, who received him at his *tabanque* or village, which, like all Bissagos villages, was about a mile distant from the shore. The royal hut, which was a round structure made of bamboos, and roofed with straw, was situated in the midst of a fine forest of orange trees. The king appeared to be a man of thirty-five, and was of a sinister and otherwise forbidding aspect. He was robed with a gaudy-coloured piece of cotton of scanty size, so that it failed to hide a hideous kind of sore common among the Negroes, which was festering on his leg. His visitor, having offered the customary presents, which included a big bottle of brandy, informed the king through one of his crew, who acted as interpreter, that he had come to the island to trade and wished to obtain palm-nuts, arachides (earth-nuts), and caoutchouc in exchange for tobacco and brandy. On hearing this, the king ordered a sacrifice to be prepared for the gods, that he might learn from its result in what manner they wished him to treat the travellers. The chief priest accordingly produced as a victim a magnificent cock; and this he decapitated, while the Minister of War held it by the head, and the Minister of Justice by the legs. Unluckily for M. Astrié, the body of the cock in dying did not flutter towards him, but in the opposite direction, and this was a fatal augury. The king at once, with a diabolical smile, withdrew to his hut, and the Minister of War informed the stranger that he and his companions were prisoners. Next day, the sloop was emptied of its cargo, which was brought to land and deposited in a safe place. The proper owner was, however, allowed to take therefrom six gallons of brandy; and these he sent to the king, who was so charmed with this present that he gave the prisoner full liberty to travel over the island wherever he pleased. To be a prisoner, yet free to travel about at large, seemed somewhat peculiar, yet this is a trait of manners common enough among the petty kings of the African Coast. Our traveller took advantage of his freedom to visit the interior of the island, accompanied by his interpreter and one of the natives. He penetrated into a forest which covered a great part of the west point of the island. This forest surpassed in beauty and majesty all those that he had ever before seen. The trees, which belonged chiefly to the family of the *Sterculiaceæ*, were of giant height, and produced a fruit having the appearance of white silk. The huge size of their trunks adapted them for being excavated, in order to make pirogues. Guava trees, palms, bamboos, and cedar trees were also noticed. The presence of the travellers startled vast numbers of birds, whose plumage was of tropical brilliancy. Negroes were found in the woods, excavating lazily, and with the rudest tools, a pirogue for the king, who alone has the right to possess this kind of craft. On returning to the village, the king informed him that he had appropriated those articles of the cargo which he liked best, and that he had sent the sloop to the neighbourhood of the river near which the Austrian ship had been wrecked. During this interview, five large gourds filled with palm-wine were set before the king, the hour having arrived at which it was his daily wont to begin his orgies. These having lasted for five hours, he fell down at last dead drunk on his mat. M. Astrié remained for six days after this, and spent most of the time in making excursions to the forest. At last, the Minister of Justice one morning begged of him that he would supply the king with five gallons of brandy. This augured well, as the despot might have appropriated the whole of the cargo without asking the owner's leave. He

therefore waited on the king, and asked his intentions as to his bartering the products of Orango for tobacco and brandy. "I have given you," he said, "all the brandy with me, and if you want more, you must permit me to sail back to Bulama for a fresh supply of that, and of such other merchandise as you may require." Upon this the king conducted him to the far-end of the village, where he showed him the interior of eight huts, in which he had various kinds of commodities stored up under lock and key—palm-kernels, bull-hides, mats, caoutchouc, rice, maize, arachides, and the spoils taken from the Austrian vessel. He then gave M. Astrié to understand that he might return to Bulama to fetch thence powder, guns, brandy, and tobacco, in exchange for which he would deliver up to him all the goods he had seen in all the huts except one. He undertook at the same time to safeguard, in his absence, the cargo which had been taken out of the sloop. M. Astrié, however, soon found that his Majesty's words were much fairer than his intentions, and artfully contrived to have the cargo replaced in the sloop without being observed, making at the same time every preparation for a speedy departure. The king soon saw how he had been outmanœuvred, and in a furious rage hastened to the beach in order to seize and massacre the whole band. He arrived, however, only in time to see the sloop weigh anchor, and bear away to sea with a strong breeze filling all her sails.

Lagos.—*L'Afrique* for May 1888 states that a provisional convention, regulating the disputes in connection with the French protectorate of Porto-Novo and the British colony of Lagos, was signed at Lagos on 2d January last by M. Victor Ballot, director of political affairs at Senegal, and in charge of the French establishments of the Gulf of Benin and the Porto-Novo Protectorate, and Mr. C. Alfred Moloney, Her Britannic Majesty's Governor and Commander-in-Chief of the Colony and Protectorate of Lagos. This convention stipulates that the French stations at Afotonu and Zuoné and the British ones at North and South Zuoné, Aguégué-Kanji, and Wétah shall be withdrawn.

AMERICA.

Ancient Cities of North America.—Professor Frederick A. Ober contributes a valuable paper on this subject to the *Bulletin* of the American Geographical Society, published in March last. He points out that the most ancient works of any extent of an early people in the United States territory are those of the so-called "Mound-builders," whose home seems to have been mainly in the Mississippi and Ohio valleys. These mound-builders have left no enduring monuments of stone, yet their earth structures are well-nigh indestructible. Then, further west, in portions of New Mexico and Arizona, we find the semi-civilised Pueblos living in vast communal buildings of "adobe" or sun-dried brick. These buildings of the Pueblos are not, however, so ancient as the "cliff dwellings," found in portions of Utah, Colorado, and Arizona. These are aerial dwellings, perched amongst the all but inaccessible cliffs of vast cañons and gorges, now existing in solitude, and long since abandoned by their builders, of whose history we know absolutely nothing. The Pueblos long preserved what was called perpetual fire, and they have still a peculiar veneration for the eagle. Between the territory of the Pueblos and the ancient cities of the south lies a vast territory, with hardly a vestige of fort or dwelling. It is only on and near Mexican territory that we encounter any tradition whatever of ancient people or ruins. The Aztecs arrived at the Toltec city of Tula about the end of the twelfth century, and after a stay of fifty years or more, went on into the

valley of Mexico. Their capital city of Tenochtitlan was founded in the year 1325, on an island in the middle of Lake Tezcoco, and here they became a great and powerful people. The Spaniards took the city in 1520, and tore down its temples and palaces. Excavations made in 1881 have brought to light the very corner-stones of the Aztec temple of sacrifice. But hardly a trace remains of the other temples and palaces of the Aztec capital. The great sacrificial stone, however, on which were slain the prisoners taken by the Aztecs in battle (not less than 70,000 in one year) is still to be seen, as also a sculpture of the Aztec god of war before whom these sacrifices took place. As to peoples who preceded the Aztecs, the vestiges of their magnificent monuments are found in the pyramids of San Juan Teotihuacan, about forty miles from Mexico city. Sixty miles south-east from that city is the world-famous pyramid of Cholula, 7000 feet above the sea, and built of adobe. It was a holy place set apart for the priests of the "God of the Air," whose temple adorned the summit of the pyramid, which rises to a height of 200 feet.

All the ruins above described are of adobe or sun-dried mud, but when we descend into the warmer regions of Mexico, below the level of the plateau, we find, says Professor Ober, "those structures of stone, that have excited the admiration of the world." The first structure occurs about seventy miles from Mexico City, on a height called Xochicalco, or "Hill of Flowers," and is a building 60 feet square, made of great blocks of porphyry. Beneath the hill are caverns, and not far off, buried in the fragrant vanilla forests, stands the pyramid of Papantla, 60 feet high, where was once a city which paid Montezuma tribute of cotton, corn, and gold. Ruins of other cities, once of great magnificence, occur in the vicinity. The marvels of Stonehenge are repeated in these old Mexican cities, with their monoliths of porphyry 18 feet in height. "How the aborigines moved these great monoliths," says Professor Ober, "or how they so skilfully carved them, are secrets never yet penetrated by modern engineers; but their quarries are quite a mile distant from the city."

The most magnificent ruins in North America are those of Palenque, once the seat of royalty, and eight miles distant from the modern town of the same name. The ruins of its palace and its temples, and a sculpture containing a mysterious figure of the Cross, make Palenque the most interesting of all the cities. At Uxmal also, sixty miles from Merida, the capital of Yucatan, wonderful pyramids of houses occur, and near it are the ruins of Kabah, with lavishly ornamented buildings. Labna, Copan, Mayapan, Chichen, Aké, Izamal, and Tuloom, are also places full of archæological interest. These were all silent cities at the advent of the Spaniard; and to find the origin of the civilisation they represent, we must, in Professor Ober's words, "go far back into the very deeps of antiquity." He concludes his most valuable and suggestive paper, by saying that the builders of these wonderful cities were Sun-worshippers, and that their civilisation was derived from the East, and from a "world older than Europe, older than Asia,—Atlantis perhaps, or a portion of our own (American) continent now beneath the waves."

Gold in Guiana.—A rich gold-field has been discovered between the rivers Lava and Papanahoui in Surinam. It is a question whether this district of 20,000 to 25,000 square kilomètres belongs to France or Holland. M. Condreau, the French traveller, who has been closely investigating the district, considers that this gold-field will be as productive as the gold-fields of Australia and California.

AUSTRALIA.

Lake George.—The *Journal of the Royal Society of New South Wales* for 1886 contains a very interesting sketch of the history of the floods in Lake George, by H. C. Russell. The lake has no outlet, and since its discovery in 1820 it has been dry twice. According to reports of the natives, the basin contained no water for some time previous to 1820. In 1823 it reached its highest level, attaining a maximum depth of twenty-four feet. Then it commenced to dry up, and in 1838 and 1839 it contained no water. In 1840 four feet of water were found in the basin, which, however, from 1845 to 1849, was again completely dry. During the ensuing ten years the lake began to fill, but in 1859 it was dry for the third time. Since that time it steadily increased in size until 1874, when it reached the same height as in 1823. This record is of great interest, as it shows the alternaing periods of humidity and dryness. It is particularly important in connection with Seibt's and Brückner's studies of similiar changes in the levels of lakes in the northern hemisphere. Brückner arrived at the conclusion that the whole of the northern hemisphere passed through a dry period between 1830 and 1840. This was followed by a period of increased humidity about 1850. A new dry period developed between 1860 and 1865, while after 1875 the precipitation increased. The periodical changes of Lake George agree with these results. From these and several other facts, Brückner infers, in reviewing Russell's paper, that the whole earth takes part in these periodical changes.—*Science*, 2d March 1888.

Statistics of Victoria (1886).—The following figures, conveying information about the trade and commerce, the shipping, public finance, population, etc., of Victoria, are extracted from the *Statistical Register of the Colony of Victoria for the Year* 1886 (compiled from official records in the office of the Government statist).

The total *imports* were valued at £18,530,575, which sum was distributed between (*a*) the United Kingdom, (*b*) other British Dominions, and (*c*) Foreign States respectively, in the following order:—(*a*) £8,741,275; (*b*) £6,567,403; (*c*) £3,221,897. Of the second of these totals £6,295,837 indicate the value of articles imported into Victoria from the various colonies of Australasia. The principal port at which the imported goods were landed was Melbourne, which absorbed £15,465,269 of the grand total. Taking the articles themselves, the first in point of value is wool (set down at £2,331,599); next comes timber (£1,170,539); then follow cottons (£962,126), live stock (£928,601), woollen goods (£892,868), sugar and molasses (£853,419), iron and steel[1] (£818,799), tea (£668,472), gold, exclusive of specie (£569,442), and coal (£510,768).

The total value of the *exports* is given as £11,795,321, articles the produce or manufacture of Victoria being valued at £9,054,687, of the United Kingdom at £1,020,218, of other British Possessions at £1,079,665, and of Foreign States at £640,751. The value of goods exported to the Australasian colonies was £4,132,589. Of the total exports the main bulk (£10,306,294 out of the £11,795,321) was despatched from the port of Melbourne. Wool was exported to the value of £4,999,662, gold (specie) to the value of £1,610,829, live stock of £393,889, flour and biscuit of £392,521, gold (exclusive of specie) of £336,874, and tea of £322,299.

As for the *shipping*, during the year there entered into Victorian ports 2307 vessels, having an aggregate burden of 1,848,058 tons (1666 steam vessels of

[1] Exclusive of railway rails, telegraph wires, etc.

1,451,315 tons ; 641 sailing of 396,743 tons). Of these 2092 (1622 steam and 470 sailing) were British, having an aggregate burden of 1,606,768 tons (1,350,195 representing the steam, and 256,573 the sailing vessels) ; and 215 (241,290 tons) were foreign (171 of 140,170 tons sailing vessels). The number of vessels that cleared was 2324, with an aggregate burden of 1,887,329 tons (1668 steam of 1,465,715 tons, and 656 sailing of 421,614 tons). Of these the British vessels numbered 2105, their total burden being 1,646,448 tons (1623 steam of 1,363,929 tons, and 482 sailing of 282,519 tons). Of foreign sailing vessels 174 (139,095 tons) cleared from Victorian ports in 1886. The shipping of Melbourne is represented by a total of 1892 vessels (1,719,487 tons) entered, and 1904 vessels (1,735,269 tons) cleared.

The general *revenue* for the year ending 30th June 1886 amounted to £6,481,021, as compared with £6,290,361 for the year preceding ; and the general *expenditure* was £6,513,540 (£6,140,356 for the year ending 30th June 1885). The Customs revenue brought in a total of £2,392,022. The heaviest expenditure was for railways, namely, £1,719,063 ; the total number of miles open for traffic being 1743. On 31st December 1886 the public debt of the colony amounted to £30,114,203, showing an increase of £1,485,615 during the preceding twelvemonth.

On 31st December 1886 the total *population* of Victoria numbered 1,003,043, of whom 531,452 were males, and 471,591 females. The number of births was 30,824, of deaths 14,952, of marriages 7737. The total number of immigrants (by sea) amounted to 93,404.

The quantity and value of the *gold* raised continues to show a steady annual decrease. Whereas in 1853 a total of 3,150,021 oz., valued at £12,600,084, was raised, and 1,627,105 oz. (£6,508,420) in 1863, 1,241,205 oz. (£4,964,820) in 1873, only 810,047 oz. (£3,240,188) was raised in 1883 ; and this figure fell to 778,618 oz. (£3,114,472) in 1884, 735,218 oz. (£2,940,872) in 1885, and 665,196 oz. (£2,660,784) in 1886.

In addition to the above, the *Statistical Register* furnishes an abundance of extremely useful information about postal matters, railways, rates of wages and prices, banks and building societies, agriculture, manufactures and industry, law and crime, education, hospitals and other benevolent institutions, being, in fact, a veritable mine of statistical wealth.

King Island.—Although separated by a comparatively narrow channel, there is a considerable difference between the flora and fauna of Australia and Tasmania. King Island lies between these lands, and a study of the animals and plants upon it was recently undertaken by a party of Australian naturalists, in order to decide its true floral and faunal position. The decision arrived at was that King Island must be considered as belonging to Tasmania. King Island is well adapted for the observations of naturalists, as it is seldom visited except by a few hunters, and the only inhabitants are the men engaged in tending the lamps in the two recently-erected lighthouses ; thus the chances of animals and plants being introduced through human agency were reduced to a minimum. Some attention was given to the geology of the island, and the evidence collected points to a recent elevation of the land. Perhaps this was best exhibited in a sand cliff, somewhat retired from present high-water mark, where layers of comminuted shells and still comparatively fresh driftwood were exposed. Much of the surface is covered with sand, and dunes line the shores. The rocks are, for the most part, granite and gneiss, but some small outcrops of sandstone and limestone are presented ; in the neighbourhood of the Fraser River the

sandstone was found to be remarkably soft, consisting of minute rounded particles of quartz, held together by a black cement. At Currie Harbour, the erosive power of waves is well illustrated, the gneissic rocks being continually broken away by the rollers, the fragments being drawn down under the sea, only to be again returned to the shore, where, rounded and reduced in size, they form a shingle beach. There are numerous "lagoons" or swamps in the interior, all having borders of sand, sometimes silvery, but more often of a black colour. Three small islands, named New Year and Sea Elephant Isles, and Yellow Rock, lie off the coasts. The principal promontories are Cape Wickham on the north coast, where there is a lighthouse; Boulder Point, Lavinia Point, Campbell Point, Bold Head, all on the east coast; Stokes Point, jutting far out and forming the southern extremity of the island, and Whistler's Point, Catavaque Point, Fitzmaurice Bluff, and Surprise Point, along the west side of the island. The bays are Sea Elephant Bay, Fitzmaurice Bight, British Admiral Bay, and Currie Harbour, the second lighthouse being situated on the latter, southward from which there is a dangerous reef. There are two considerable elevations on the island, Sea Elephant Hill towards the north, and Mount Stanley towards the south. The rivers have been named the Pass River, Etterick River, Fraser River, Sea Elephant River, Seal River, with the Eel and Porky Creeks. Seal River has a very short course; it rises from the only sheet of water on the island that deserves the name of lake, and falls into the sea near Stokes Point.

Thick forests cover part of the ground; the blue gum being one of the most common trees. The island was well worthy of examination, and the naturalists appear to have done their work well, so far as they extended their survey. Had they, however, explored the interior more thoroughly, the lists compiled might have been considerably enlarged. A series of photographs, twenty-two in number, was taken by some of the party, and a rough map of the island was made.

MISCELLANEOUS.

The **Wheat exported from India** last year exceeded 1,000,000 tons. This trade is comparatively new, having sprung up since the opening of the Suez Canal, and has annually increased in importance since the removal of the duty which, with the long voyage, formerly crippled it. Last year this country alone received 600,000 tons of wheat from India, a quantity considerably in excess of what we imported from Russia.

Mr. Cruls, the Director of the Imperial Observatory at Rio de Janeiro, has (says the *Bulletin* of the American Geographical Society for March 1888) undertaken the task of preparing a universal **Climatological Dictionary**, to be printed under the auspices and at the expense of the Observatory. The Director desires the co-operation of all meteorological institutions throughout the world, and furnishes printed forms of the information described.

Mr. Charles White has communicated to the Odontological Society the results of an examination of **Human Teeth** of **the Stone Age**, which show, to some extent at least, what constituted the food of the people of that period. From the calcareously-sealed dental tartar of selected teeth he extracted particles of food which had been preserved in this matter for thousands of years. He decalcined some with dilute hydrochloric acid, and subjected the sediment obtained to a rigid examination. This residue was found to consist of epithelial scales mixed with the contents of starch cells. He also recognised minute particles of husks

of corn, hairs from the exterior of the husks, spiral vessels from vegetables, husks of starch, the point of a fish's tooth, a conglomeration of oval cells supposed to be of fruits, barblets of feathers, portions of wool, bits of cartilage, and a considerable quantity of organic remains which he was unable to recognise. Mr. White's experiment has been an interesting one, and may result in discoveries of high ethnological importance.

NEW BOOKS.

A Season in Sutherland. By JOHN E. EDWARDS-MOSS. London: Macmillan and Co., 1888. *Price* 4*s.* 6*d.*

Mr. Edwards-Moss has, in this sketch of a season spent on "bonnie Strathnaver, Sutherland's pride," shown himself to be a keen observer and lover of nature, and a no less keen enjoyer and lover of sport. He writes well and freshly. No one who knows Lord Reay's country but must long to revisit it after its many charms and beauties are recalled by a perusal of these pages. Strangers to this delightful district may feel inclined to doubt that so much beauty and variety can be found in a region so remote and so far north, but the author does not exaggerate; indeed, there are many points not touched upon which would have well repaid a passing notice. We have much information about angling, and something about the habits of the salmon, and the causes which make some rivers "late" and others "early." We agree with the author in his conclusion as to the temperature of the water being the chief governing power which guides the movements of the fish, but see no reason for making a fag-end of the much-enduring Gulf Stream do duty as one of the factors. The length of a river's course and its exposure, the depth of its waters, and the nature of its banks have, among other causes, much to do with the temperature of the stream, and as these vary in each stream so will the heat of the water, which, in the "running" season, may closely approximate to that of the sea at its mouth, or differ greatly from it. The ideas of the author as to the improvement of the Borgie seem just, and he has our best wishes for the successful issue of his experiments. But Mr. Edwards-Moss does not devote his whole attention to the fauna and flora of Strathnaver; he has a keen eye for character, and truly, but not unkindly, sketches the inhabitants—their good-nature, cheerful disposition, and unutterable want of enterprise and push. Of the latter pre-eminently Celtic characteristic he is able to give some amusing examples. Regarding the superstitions of the district we also hear something; but it is rather disappointing to find that the author, who is great at nothing if not at quotation, appears to be ignorant of the most interesting correspondence between the Lord Reay of 1699, Mr. Pepys, and other *savants* of that period. We feel sure that, did Mr. Edwards-Moss know of these letters, he would not have lost the opportunity of adding some of their quaint, old-world lines to his pleasant pages, especially as several of the instances mentioned occurred in Strathnaver. Altogether, the little volume is thoroughly enjoyable; once taken up it will not be readily laid down till the last page is reached. It is a pity that the proof-sheets have, apparently, been carelessly read, resulting in several unsightly mistakes in spell- and punctuation, *e.g.*, where the Scottish reader may well be excused for incredulity when fishing for "cuddies" is mentioned. The book would also have been improved by the addition of an index.

Our English Shores: Recollections of Watering-Places on the Coasts of England. By William Miller, F.R.S.E. Illustrated by Sixty Engravings. Pp. xvi + 234. Edinburgh: Oliphant, Anderson, and Ferrier, 1888. *Price* 6*s.*

The author presents us with a brief description of the principal places of interest on the English coasts. Some of them he has frequently visited, not merely as a tourist, but as one who has studied with care and intelligence their many beauties, their surroundings, and their attractions; and he does not omit to notice drawbacks and to suggest improvements. Not the least interesting part of Mr. Miller's work is contained in the chapters which go beyond the bounds indicated by the title, and are descriptive of visits to the Channel Islands and the North-West of France. Throughout his journeyings the author was busy with his pencil, and the results are given in the form of numerous engravings.

The value of the book as a Guide might be greatly increased by the addition of a map, and a section devoted to tabulating the best routes and usual scale of charges.

Itinerary through Corsica by its Rail, Carriage, and Forest Roads. By C. B. Black. Illustrated by five Maps and one Plan (of Ajaccio). Edinburgh: Adam and Charles Black, 1888. Pp. 44. *Price* 1*s.*

This is a very handy and complete Guide to Corsica. Mr. C. B. Black's Guides to France are so well known that when we say that this one is framed on the same lines, and that the maps are equally clear and excellent, we shall award it the praise it deserves. We should have liked Mr. Black to have given us a few more meteorological and other data showing the attractions of Corsica as a health resort. He tells us that "Along the coast the sun is warm even in January. After January the temperature rises rapidly. The climate of the zone 2000 feet above the sea is considerably colder, and snow generally appears there in December." With regard to Ajaccio, the capital of Corsica, a town of 19,050 inhabitants, Mr. Black says, "For convalescent invalids, Ajaccio forms a delightful change from the Riviera, as it is so rural and has such pleasant air and good water. The hotels are comfortable and their charges moderate." Mr. Black does not, however, speak highly of the inhabitants of Corsica. He says: "The Corsicans look to the Government for the improvement of their island far more than to their own efforts, for they themselves are neither industrious nor enterprising. The roads, railways, bridges, and other public works are constructed chiefly by Italian labourers." Again: "The inhabitants do not assist nature. The seed potatoes are of an inferior class, their fruit trees receive little attention, very few of the vineyards are carefully cultivated, and their sheep, goats, and pigs are of poor breeds." Although France possesses a Ministry of Agriculture, Corsica does not seem to benefit much by "looking to the Government" for the much needed agricultural and other improvements. According to Mr. Black, the "glorious chestnut and beech forests when in full foliage are the grand features of Corsican scenery, which therefore cannot be seen to advantage till towards the end of May, and if to this we add the splendid bloom of the oleanders, not till July."

Walks in Algiers and its Surroundings. By L. G. Séguin. A New Edition with two Maps. London: Chatto and Windus, 1888. Pp. 501. *Price* 6*s.*

Algiers has become such a favourite winter resort that we are not surprised that a new edition of this very readable and useful book has been called for. The winter climate of Algiers is, of course, its great attraction, and when we

contrast the mean temperature of the town of Algiers during December (60° F.), January and February (59°), and March (60°) with that of, say Edinburgh, during December (39° F.), January (36°), February (39°), and March (40°), the reason for the annual flight of British invalids and others to Algiers is not difficult to understand. Miss Séguin furnishes no tables of rainfall, but assures us that "in spite of statistics, Algiers must be considered to possess an especially dry climate," and, rightly or wrongly, she gives the "absence of mosquitoes" as a "sufficiently good proof of this." She tells us that there are wonderfully few French visitors at Algiers, and that it is "being gradually taken possession of by the English." She laments the absence of a "really first-class hotel in Algiers, such as may be met with in other winter stations frequented by the English," but this comment is uncorrected from the first edition, and excellent hotels now exist. She has an interesting chapter on the various native races in Algiers, viz.:—1. *The Arabs*.—These, she says, will, as individuals, "be found kindly and courteous, and very well disposed towards the English, whom they distinguish instantly from the French and regard with much more favour." 2. *The Moors*, "called *Hadars* or dwellers in houses by the Arabs," and who are "a mixed race, the descendants of Arabs, Turks, and Europeans." They were the pirates of bygone days, and now "form the mercantile or shopkeeping class of Algiers, the wealthiest among the natives." 3. *The Kabyles*, the mountaineers, who were the inhabitants of the country before the Arab invasion. 4. *The Negroes*, who are an extremely industrious, gay, and contented race." 5. *The Mozabites*, who "with the shining black skin of the negro, can boast of well-shaped noses and Egyptian-looking mouths.' They come from a country called Mozab south of El-Aghuat and actually in the Great Sahara. They are supposed to be identical with the Moabites of Scripture. 6. *The Biskris*, who are the scavengers, porters, and water-carriers of Algiers come, if not from Biskra, as their name implies, from some inland province of Algeria. 7. *Jews*. These number about 7000, and, "by their quaint costumes and handsome faces, add not a little to the general effect." The Jews were much oppressed by Arabs and Moors before the French occupation, and the favour since shown them is said to have occasioned the Arab revolt of 1871. The remainder of Miss Séguin's interesting volume is devoted to a description of Algiers and its environs, with historical chapters of much value. She points out that the antagonistic modes of life and habits of thought of Frenchmen and Arabs made the French colonisation of Algeria exceedingly difficult. "All that the Arab reverences, the Frenchman scorns; all that the Frenchman delights in, the Arab loathes." Still, the author acknowledges that the occupation of Algiers by the French during the past 47 years has been productive of much good; and remarks that "when we consider the state of utter barbarism in which the whole country was wrapped not half-a-century ago, and see it now peaceable, secure, already cultivated very largely, and beginning to prosper—instead of being surprised at what is left undone, we may justly admire that which has been achieved, while we heartily wish for our neighbours across Channel success in their first serious attempt at colonisation."

Golden South Africa, or The Gold Fields Revisited: being Further Glimpses of the Gold Fields of South Africa. By Edward P. Mathers, F.R.G.S. London: W. B. Whittingham and Co., 1888. Pp. viii. and 390. *Price* 2*s.* 6*d.*

This book is a guide to the South African Gold Fields, by a Natal newspaper correspondent, and contains the account of two trips there, one in 1884 and the

other three years later. The first journey was made by Delagoa Bay, and the author dwells on the unhealthiness of the district to be passed through, and the hardships to be undergone. After "a glimpse at Moodies in the early days," Mr. Mathers returned by the Natal route. On the second visit to Barberton he describes the change from a mere mining camp to a town larger than Kimberley was five years after its commencement, and notes the transference of the claims from individuals to companies, many of them floated in London. He gives a list of the most important companies, and the work they are doing. The next fields visited were the Komatie, after which the author went to Swazieland. Here he gives an interesting account of King Umbandine and his relations to the British and Boer Governments. After visiting the Lydenburg Fields, Mr. Mathers travelled by coach to Pretoria in order to visit the Witwatersrand. He gives an account of an interview with President Krüger, and then describes the different properties at the Rand and in its neighbourhood, and also the other gold-producing districts in the Transvaal or near its borders. The book impresses one with the idea that there is a great future before the Gold Fields of South Africa, if only the work of mining and crushing is gone about in the right way. The Appendices contain tables of the distances to the different fields, and a list of the companies then working.

Among the Mongols. By the Rev. James Gilmour, M.A., London Mission. Peking. London: The Religious Tract Society, 1888. *Price* 2*s.* 6*d.*

From a prefatory note by the publishers we learn that this work in its original form had a large circulation and excited an unusual amount of interest. We are not surprised to learn this, as it has merits of no ordinary kind which should make it rank even as a classic in the department of literature to which it belongs. The success which it has met with is, we think, mainly to be attributed to the fact that the author is the master of a fascinating literary style, which, from its simplicity, clearness, and vigour, as well as the vividness with which it impresses scenes and incidents on the mind, almost rivals the style of Defoe himself. The aim of his work, as he states in his preface, is to represent whatever is most noteworthy in the home-life, manners and customs, occupations and surroundings, modes of thought, superstitions, and religious beliefs and practices of the Mongol tribes who inhabit the Eastern portion of the plateau of Central Asia, lying between Siberia in the north and China in the south. The author has fulfilled his aim in a way that scarcely leaves anything to be desired. As we turn his pages we seem to be for the time in Mongolia, and to become intimate both with the inner and the outer life of its people. In the opening chapters he details the incidents of a journey of 840 miles which he made from Kulgan, on the north frontier of China, to Kiatcha, on the south frontier of Russia. The route lay partly through the great desert of Gobi, and of its desolate and weird aspect he gives an impressive description. On emerging from its solitudes he reached Urga, the religious capital of the Mongols, which is about 600 miles from Kulgan. North of this place the aspect of the country entirely changed. In place of the desert plains he found a mountainous region clothed with forests, and intersected by streams running through fertile valleys. After travelling for a month he reached Kiatcha and civilisation. Before setting out on the return journey he visited Lake Baikal, which he crossed on the ice. To this lake the Russians ascribe something of a sacred character, speaking of it as the Holy Sea. He visited also Irkutsk, the capital of Siberia, which he says not only looks well in the distance but bears even a close inspection. Multifarious details regarding Mongol life in all its varied aspects fill the rest of his very interesting volume.

The people he describes as humane and hospitable, but as indolent, filthy in their habits, extremely superstitious and more addicted to the outward observances of religion than any other people on the face of the earth. Their religion is a form of Buddhism called Lamaism, in which the metempsychosis is one of the most prominent and influential doctrines. Their firm belief in it leads them to be very kind to the lower animals. They are less than kind, however, to their women, whom they subject to such hard conditions of life as condemn them to premature decay and death. The lamas or priests are so numerous that they form about a half of the whole male population. They are extremely profligate, and stop short of no crime but murder. Their evil example has, of course, served to corrupt the morals of the laity. In Urga, which is the seat, or Encampment as it is called, of their Grand Lama, vice in all its most degrading forms is rampant. One statement made by the author fills us with surprise. The Mongols, he says, are now-a-days, whatever they may have been in former times, cowards. This is surely enough to make Genghis Khan and Tamerlane turn in their graves. The book, we may add, is illustrated with numerous wood-cuts, some of which are from drawings by a Chinese artist.

Manual of Burmese. By Captain Charles Slack. London : Trübner and Co., 1888. *Price* 2*s.* 6*d.*

This useful little book has been compiled by Captain Slack as a companion volume to his *Manual of Languages* for travellers and students, and is intended to assist the traveller in the study of the Burmese language, and to aid him in at once communicating with the natives. The author has succeeded fairly well in representing the Burmese sounds by the Roman letters, though it is most difficult to indicate by these means many of the words in daily use among the people. The chief part of the book is occupied by a full vocabulary, and a collection of short sentences which the traveller will find he needs at once on landing. A short grammar, tables of moneys, weights, and measures, and a small gazetteer, with a map of the country, complete this little handbook, which will take up very little room in the pocket, and should be carried by every one who intends spending a long or short time in the country.

The Wealth and Progress of New South Wales, 1886-87. By T. A. Coghlan, Government Statistician. With Map and Tables. Sydney : George Robertson and Co., 1887. Pp. 567.

This volume has been compiled as a landmark to commemorate the centenary of the foundation of New South Wales. After a short historical sketch, the physical geography, geology, and natural resources of the colony are concisely described, and the statistics of population, commerce, railways, and government are treated at considerable length. It illustrates the great prosperity and continuous development of this part of Australia, and as a compendium of authoritative data it should prove of value for reference. The accompanying map is coloured to show the predominating industries of the various districts.

Among the Cannibals of New Guinea : Being the Story of the New Guinea Mission of the London Missionary Society. By Rev. S. M'Farlane, LL.D. F.R.G.S., &c. Illustrated with a series of Original Drawings by an Artist who has visited the Island. London : London Missionary Society, 1888. *Price* 5*s.*

The history of the New Guinea Mission is one of more than ordinary interest and importance, and Dr. M'Farlane tells the story of the trials and triumphs of

the missionary pioneers in a singularly delightful manner, carrying the reader sympathetically along with him in all his journeys, difficulties, privations, and conquests. This volume is the first of a proposed series of "Missionary Manuals," which, if the same high standard be maintained throughout, should prove valuable publications.

There are few pages that do not bear evidence that the author could tell us much more concerning New Guinea than he has done—the plan of the work has evidently made him chary of devoting too much space to purely geographical details; indeed, considering that the book is essentially a narrative of missionary labour, we are glad to find so much information regarding the country and its resources as is included in the work before us. We hope that at no very distant date we may be able to welcome a fuller and more extended description of the country from the same facile pen.

The portions of the book which fall under our more immediate notice are the chapters on exploration, and on the manners and customs of the natives. Both are valuable, abound in stirring episodes, and enter into considerable detail. The early missionaries found their work cut out for them, but they, without hesitation, grappled with their many difficulties, and fearlessly faced every danger, and may now look back upon their past labours with a considerable degree of satisfaction.

The illustrations are excellent, the letterpress clear, and the paper good; the map of part of the island is, however, more of a skeleton than it might have been, and contrasts unfavourably with the other illustrations. The London Missionary Society should note, when they come to publish the remainder of the series, that an index usually accompanies books intended to be of any permanent value.

California of the South: its Physical Geography, Climate, Resources, Routes of Travel, and Health Resorts, being a Complete Guide-Book to Southern California. By Walter Lindley, M.D., and J. P. Widney, A.M., M.D. With Maps and Illustrations. New York: D. Appleton and Co., 1888.

As set forth in the title, this book is a most complete and instructive guide-book to Southern California, as well as a reliable work of reference for everything pertaining to that part of America. It gives most interesting information about the health resorts, routes of travel, mines, agriculture, commerce, climate, topography, politics, etc. etc. The illustrations are excellent and the maps well executed. In one map, the mean annual temperature of different regions is shown in colours. It is a book to be consulted, not only by the invalid in search of a healthy climate, but by intending settlers in the rich agricultural lands of the Pacific slope.

British Guiana Directory and Almanac for 1888. Georgetown, Demerara: C. K. Jardine.

This is a neatly got-up and very complete Directory, giving many useful and interesting particulars regarding British Guiana, the population of which, according to the Census of 1881, was 252,186, but the area of which is very extensive. The Directory informs us that it is "difficult to determine with exactitude the area of the colony of British Guiana, since its boundaries, not only on the side of Venezuela but on that of Brazil, are undetermined. Assuming its limits to be those which the geographical features of the territory would indicate, the area would be equal to 76,000 square miles." As to the climate of British Guiana, it is stated to be "far from unhealthy, as is

generally supposed by persons unacquainted with the colony." Epidemics of yellow fever are said to be the cause of this distrust, but such epidemics not only "occur at long intervals," but are "chiefly confined to the towns at the mouths of rivers and rarely extend inland." From a table of Rainfall returns from 1851 to 1887 we observe that the annual rainfall ranged between 110 inches (in 1865) and 44 inches (in 1868). Guiana is said to be free from the hurricanes which prove so destructive in the West Indies. The temperature of British Guiana seldom falls below 75° F. or rises above 90° F. The mean annual temperature of Georgetown, the capital, is 80° F. and its average rainfall is 100 inches. The staple products of the colony are sugar, rum, molasses, timber, coffee, cocoa, rice, coconuts, charcoal, and gold; and the total value of the exports, in 1886, was £1,822,585. In 1881, there were 4393 Chinese in British Guiana, and we are told that "as agricultural labourers, the Chinese are ranked higher than the East Indian immigrants (these numbering 65,161), and their value as consumers is also greater."

The Caribbean Confederation. With a Map. A plan for the union of the fifteen British West Indian Colonies, preceded by an account of the past and present condition of the Europeans and the African races inhabiting them, with a true explanation of the Haytian Mystery, in which is embodied a Refutation of the Chief Statements made by Mr. Froude in his Recent Work *The English in the West Indies.* By C. S. Salmon, late President of Nevis; formerly Colonial Secretary and Administrator of the Government of the Gold Coast; Chief Commissioner Seychelles Islands, etc.; Member of the Committee of the Cobden Club. "Free Trade, Peace, Goodwill among Nations." London, Paris, New York, and Melbourne: Cassell and Company, Limited. Not dated. Pp. 175. *Price* 1*s.* 6*d.*

Yet this seventeenth century title-page is followed by a preface stating the purpose and contents of the pamphlet. These are to show that Negroes are as ready and ripe for local self-government as the people of Great Britain and Ireland, and that this measure, combined with a confederation of the colonies, will put the West Indies on a satisfactory footing at last. Although largely political, the book contains facts regarding the commerce of the colonies, and is illustrated by a good map.

L'Atmosphère, Météorologie Populaire. Par Camille Flammarion. Paris: Hachette et Cie., 1888.

This work professes to give a popular review of modern knowledge in all branches of meteorology, and includes an account of the physical properties of air and water-vapour, with occasional digressions into astronomical questions. As might be expected, where so much is attempted, not very much is accomplished. Much of the meteorology is antiquated, while on the other hand a number of modern theories are set forth as established results, and a good many misleading statements are made. As an example we may refer to the discussion of barometric variations. On page 75, we find a figure showing the variations of atmospheric pressure with *latitude*—nothing being said as to effects of land and sea, or differences in the two hemispheres. Further on, (page 369,) a table showing the daily range of the barometer in *different latitudes* is exhibited, and we are informed that the amplitude of this range at any place is in general a function of the mean temperature. It is needless to multiply quotations—matter of this kind runs through the whole book. Where ascertained facts only are concerned, which admit of elementary explanation, there is much that is good, but it is so

hopelessly involved with what is either merely more or less probable conjecture, or from its nature is not capable of popular exposition, that the general effect must be pernicious. From an artistic point of view the illustrations are of very great merit, particularly the engravings, and the printing and "making up" of the book are admirable.

Earthquakes: Their History, Phenomena, and Probable Causes. By MUNGO PONTON, F.R.S.E. New and Revised Edition. London: T. Nelson & Sons, 1888. Pp. 220. *Price* 2*s.* 6*d.*

This is a popular treatise on earthquakes, with numerous illustrations, including scenes connected with the earthquakes in Ischia in 1883 and in Spain in 1884. Graphic accounts by eye-witnesses of the earthquake in the Riviera on 23d February 1887 are also given. Mr. Ponton states that, whilst few parts of the earth's surface can be regarded as exempt from earthquakes, the Earthquake Map prepared for the British Association in 1858 showed that the lines of greatest earthquake intensity over the globe follow, for the most part, the sea-coast. "Africa *appears* to be comparatively free from earthquake action, and also Australia; but in both cases the apparent exemption may be due merely to the absence of records. It is remarkable, however, that while the western portions of South America, especially between the Andes and the sea, are frequently and violently convulsed, the eastern portions of that continent enjoy a wonderful immunity." Mr. Ponton reminds us that, whilst the earthquake which in November 1755 laid Lisbon in ruins, produced no perceptible motion in the soil of Northern Europe, it caused slow oscillations of the water in lakes, ponds, and canals in the north. Thus the water of Loch Lomond rose and fell about 2½ feet every five minutes, and other British, Scandinavian, and North American lakes were simultaneously agitated. The book is a useful and interesting one, especially as relating to phenomena of unhappily frequent occurrence.

Gospel Ethnology. By S. R. PATTISON. London: The Religious Tract Society. *Price* 5*s.*

This practical and prettily illustrated work is a skilful application of the science of ethnology to Christianity. The writer shows, from the experience and testimony of historians and missionaries, that the Gospel has been received, wherever it has been presented and explained, by people of every class and tribe and colour, "with eagerness and assent," and so proves the divinity of its origin on the one hand, and the physical and spiritual unity of man on the other. He surveys first the three black races of man accepting Christianity; then the fifteen yellow races; then the fourteen brown and white races. "There is therefore the fullest warrant for the universal preaching of the Gospel. We are acting in a scientific manner in promoting Christian missions." The book is well written.

Maritime Discovery and Adventure. Pp. 224. London and Edinburgh: W. and R. Chambers, 1888. *Price* 2*s.*

This little book consists of brief accounts of voyages, chiefly undertaken in the interests of exploration and science, from the days of Columbus to our own time. The amount of hardship undergone, and almost superhuman courage displayed by many of these pioneers, is related in a concise form, bringing such knowledge within the reach of those who either cannot or will not read more voluminous works of travel. It is clearly printed, and furnished with numerous illustrations.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

NOTES ON THE DUTCH EAST INDIES, 1888.

By Emil Metzger,

Hon. Corr. Mem. Royal Scottish Geographical Society.

II.—The Economic and Industrial Situation.

Introduction.—In order to render intelligible, to those who are not thoroughly conversant with the march of events in the Dutch East Indies, the actual position of affairs at the present moment, it will be necessary to cast a retrospective glance at the changes which have taken place there during the last forty years.

At the beginning of the period indicated the system of Van den Bosch prevailed, and held undisputed ground; but its reign was of comparatively brief duration. Those who condemned it kept up a vigorous opposition, and to such effect that even before the legislative action of the Government, for the purpose of modifying the laws, came into operation, the treatment of the natives had undergone an alteration that was deserving of nothing but praise. It was, of course, impossible to abolish by a single stroke of the pen all the evils and abuses which the chiefs had inflicted, as a sort of secular bequest, upon the natives who were subject to them. And this oppression of the people by those who ruled them, instead of being mitigated or removed by the arrival of Europeans, was, on the contrary, greatly intensified; for the white men, in making themselves masters of the island, assumed to themselves the rights of mastership over the thews and sinews of the native populations, and compelled them to cultivate just those kinds of produce which would fetch the highest prices in the market; but of these returns the actual cultivator, the down-trodden native, got but the barest fraction.

At length an effort was made to put a stop to the selfish proceedings

of, even, some European officers in the service of the Government, and to check the influence for mischief which they were exercising upon the native population. In the case of the native chiefs, however, it was not so easy to apply the same remedial measures as were employed against the Europeans; and this for obvious reasons. Those who desire to obtain a fuller grasp of the situation at that time should read the interesting chapter on the subject in *Max Havelaar*, by the late Douwes Dekker (Multatuli), which gives a more faithful representation of the real aspect of affairs than Mr. Wallace was inclined to believe.

Meanwhile matters were progressing at home in Europe: the opponents of the Van den Bosch policy were gaining ground day by day, and about a quarter of a century ago the Liberal party carried off the victory which was at that time so urgently desired, but which unfortunately gave comparatively little relief.

A few years previously Mr. Money had visited Java, and conceived such a high opinion of what he saw there, that he took it as a pattern whereon to construct his book, *How to Manage a Colony*. Yet it strikes me very forcibly that he can have seen only the bright side of the picture, and that its reverse escaped his observation, otherwise his satisfaction would have been less; and how this could happen may be easily explained. In the East Indies the authorities were perfect adepts, and that from of old time, in the art of showing a traveller just such things as he wished to see, without letting him perceive too much. And owing to the brilliant gilding of wealth which covered everything that came under the traveller's observation, it would have been a matter of great difficulty to have perceived the dark features of the actual reality. By what complicated machinery Catherine II. was deceived on the occasion of her visit to the Crimea, in 1787, will doubtless be well known to the reader. In Java, of course, no such elaborate devices were put in operation; but the visitor to the island who stuck to the principal highways, which were scrupulously kept in good repair, or to other roads chosen for him by the authorities, met none but well-dressed, prosperous-looking natives, and when he came to what our cousins in Hindustan would call a *bungalow* (and what is called in Java a *pasangrahan*) he met with a most hospitable reception, the choicest productions of the country being set before him in bountiful profusion, his digestion of which was not even impaired by the presentation of a bill. If now and then a traveller did give a fee, he did it entirely of his own free-will. But the naked truth about the matter was this—the refreshments with which he had regaled himself had been provided at the expense of the indigent native; the chief to whose charge the pasangrahan was committed, levied whatever supplies were required for those places of entertainment upon his own subjects, frequently exacting four times as much as was required, or even more. The thought that naturally arose in the mind of the stranger when he saw before him the great number of dishes which accompanied the rice, the homely fare of the natives, and the divers varieties of sweetmeats that were offered along with a cup of tea, and noticed the well-dressed attendants who waited upon him, was one of admiration at the richness and prosperity of the country he was travelling through.

Yet at the selfsame moment, whilst he was perhaps listening to the soft melodies of the *angklong*, or enjoying the performances of the dancing-girls, only a few yards distant from the place on which he was reclining, a byroad would be crowded with panting buffaloes, carrying down to the seaport the colonial wares that the Government estimated at such a high value, whilst their owners, who had been summoned from their rice-fields to perform forced labour for the *Tuwan Besar*,[1] toiled along beside them; and on another path a long file of men, women, and children, half naked and exhausted, were being driven along by their chiefs, who, as agents and overseers of the white men, were taking their subjects to work in the coffee plantations, which were sometimes 30, or even 60 miles distant from their own homes.

But, as I have already stated, better times came, and a sincere and earnest desire was manifested to ameliorate the condition of the natives; nay more, not only were important improvements effected, but real sacrifices were made with the view to attain the desired end. The influence of the chiefs was broken down, or rather, a steady effort was made to break it down; for I scarcely think that the attempt has been successful, even down to the present day. Two methods in particular were adopted for the purpose of undermining the tyrannical authority of the chiefs. In the first place, they were no longer allowed to live at the expense of the natives, or to raise duties, or compel their subjects to give forced labour, without restriction and without control. Besides this, certain regulations, which had been drawn up a long time before, but had not been so well enforced as they ought to have been, were made more stringent, and at the same time were more strictly carried out. Through the operation of these new legislative enactments the native chiefs of course suffered considerably; the Government, therefore, in order to indemnify them for the material losses inflicted upon them, agreed to pay them an adequate recompense. Hence they became substantially, what they had long been in mere name, officers in the service of the Government.

Another remedial measure to which recourse was had, in order to cure the evils of the system, was to increase the number of European officers appointed to superintend the work of their native colleagues. Besides this, it was attempted to raise the natives to a higher level by giving them better teachers, and by various other measures, which are too numerous to be mentioned here.

At all times the great problem that faced the Dutch administrators in Java was, how the native population could be taught to work. The Javanese and other peoples who inhabit Indonesia were, like all who live in tropical climates, greatly averse to steady labour. All Europeans, however, to whatever political party they belonged, were fully agreed as to the necessity of developing in the natives habits of greater industry. The crucial question was: How was this to be brought about? The upholders of the "inveterate abuses," as they were designated by the Liberals, advocated a method similar to that which is employed in the

[1] The Great Master (The Governor-General of the D. E. Indies).

case of children who are reluctant to swallow a nauseous medicine, and urged that they should be compelled to work *nolens volens* in the Government plantations, although for that work they received the very smallest remuneration—in some instances, indeed, almost none at all. The people, by dint of continual labour would, it was urged, eventually reconcile themselves to it, and perhaps even acquire a liking for it. The task which the opposing political party set themselves, therefore, was to deliver the natives from the yoke of what they called disguised slavery to which they were subjugated, and with this they also combined the policy of teaching them how to work, and thereby earn a living for themselves.

There was yet another circumstance which concurred to lend additional weight to the endeavours of the partisans of free labour. During the time that the old system flourished in full vigour, only a few privileged individuals had been allowed to settle in the Dutch East Indies, and these were, for the greater part, employed by the Government, in preparing for the European market the colonial produce grown on the Government plantations. Most of these people amassed large fortunes, and, on their return to the Netherlands, created a good deal of astonishment and envy by the display of vast wealth. At last the idea became rooted in the popular mind that any man who went out to the East, and was able successfully to withstand the climate, could hardly fail to return a nabob. And this idea gained more and more ground, and found readier credence in proportion as the proceedings of the Government became publicly known; and the fact that the *Batig-Slot*, or surplus on the annual budget, was greater than it used to be in former times, impressed itself upon the consciousness of the people of the Netherlands. Of course, the ambition to open out plantations in the East Indies and to do likewise,—*i.e.* gather in the treasures of the tropics—proved contagious, and many were smitten with it. It was plainly perceived that such industries as were carried on under the direction of the colonial Government might be worked to much greater profit if they were managed on a scale not too large, and yet on one that was not too small either, and were conducted by specially qualified persons—those who had had a technical training in the several particular industries prosecuted. Accordingly, it was not long before public opinion began to shape and formulate itself in some such terms as these:—The natives must be freed from the burdens of servitude laid upon them by the Government, in order that they might be at liberty to dispose of their time at their own discretion, and so be able to work for private individuals, who could either undertake the management of the plantations which hitherto had been under the control of the Government, or else open out new ones for themselves on virgin soil.

A very great deal had of course to be done before these ideas could be practically realised and got to take definite shape, and it was not until the year 1870 that the "Agrarian Law," which facilitated the establishment of plantations by private individuals, was promulgated. For whilst in the Netherlands it was felt that the lot of the natives was a hard one, and themselves greatly to be commiserated, yet the substantial gains made through the Government plantations were highly appreciated, and

it would be a hard thing to abandon the *Batig-Slot*, or surplus revenue, and the profits accruing from the various industries carried on by the Government.

But although the private planter had extorted from the Colonial Government the concession of the right to establish himself in Java and other islands, yet the old system was not entirely abolished, but continued to exist side by side with that of private ownership and private enterprise. This state of things, however, could, it is abundantly manifest, lead only to disastrous confusion in the East. The Government continued to dispose of the land and of the native supplies of labour. Hence private individuals, who went to the East Indies for the purpose of starting as planters, had to acquire whatever ground they required from the Government; whilst, as for the labour they needed, they had to get it as best they could. In the matter of land it need scarcely be observed that the Government had the preference, and retained all the best and most fertile soil for themselves. With respect to labourers, there were, apart from the native population, none—at least this was the case in Java; and the native labourers could not go to work in the plantations of private individuals so long as their own chiefs wanted them to labour for the *Tuwan Besar*.

From all this it will easily be understood that the planter *in spe* had a good many difficulties to encounter before the land he applied for was granted to him; and then, if his patience or tenacity of purpose proved superior to all the hindrances thrown in his way by the Government, and he did finally succeed in securing the titles to his land, he still had to make shift as best as he could to find work-people by trying to win the friendship of the native chiefs. Add to all this, that the Government behaved, at least until recently, in no generous spirit towards the private planters, but vexed them with very heavy duties, taxes, etc.

Soon, however, the natives began to be alive to the advantages that might accrue to themselves out of these adverse circumstances. For, whereas hitherto they had been bound to work for the Government for the barest pittance of a return—wages or remuneration, at least in some instances, it cannot be called—they now began to understand the prospect that was opening up before them, namely, that they could earn more money by labouring for private individuals. And although they were not always allowed to do this, they became thoroughly awake to the situation, and grew discontented, and, whilst not openly resisting the corvée levied upon them, they rendered it in an unwilling spirit, so that many plantations may for that reason have been neglected. But as the general public in Europe were fully persuaded that fortunes could easily be made by working plantations in Java, great numbers of private persons continued to come into the island, several of them without much knowledge of the agricultural requirements of planting, others without a sufficiency of capital wherewith to contend against the vicissitudes of pioneering, and sometimes, therefore, left wholly at the mercy of those who furnished them with the necessary funds. At one time, indeed, it was a favourite speculation to apply for land without any intention of cultivating it, and sometimes without the capital required to do so, and then, when the

titles were secured, to sell it, if possible to the owner of an adjoining estate, who was often glad to purchase it in order to cut off the competition of the new-comer.

Another circumstance also occurred at that time which contributed greatly to augment the European element in the Dutch East Indies. Shortly before the Agrarian Law was passed, the Suez Canal was opened; and what important changes followed in the far East from that event will doubtless be within the range of experience of many readers of this Magazine; and of these changes the Dutch East Indies came in for an ample share. Suffice it to say that, previous to that event the East Indian possessions of the Netherlands had been practically almost shut off from the rest of the world, and that during the last twenty years they have fully participated in the enormous and rapid progress which has been made throughout all quarters of the civilised globe, and the magnitude of the changes that have come over Java and its sister islands will be to some extent understood. Suddenly the island was inundated with a stream of new ideas poured into it by the crowds of Europeans who flocked thither, very many of them to enter the service of the Government, and many also with the design of prosecuting business on their own account. There were in the East Indies in the year 1859, 27,330 Europeans (exclusive of the military), of whom 20,776 were in Java; in 1874 there were 34,212, of whom 27,571 were in Java; in 1885 the number had risen to 50,491 (40,046 in Java). Up to twenty or thirty years ago the annual arrivals in the Dutch East Indies were scarcely more than sufficient to make up for the ordinary losses sustained by the resident European population. These arrivals generally disappeared in the crowd, being absorbed into the general body of European society; some of them, of course, acquired a certain degree of personal influence, but in general that did not happen until they had been assimilated to the Indian world, and acquired in it a position which of itself was calculated to give weight to their opinion; but that process again almost invariably resulted in their original opinions being greatly modified in conformity with the views and aims current in colonial society. Later on, however, when immigrants from Europe began to arrive in greater numbers, they were too many to be thus absorbed into the body of the East Indian residents; their numbers, too, gave weight to their opinions and sentiments; they held together, and refused to submit to the assimilating process as it had hitherto gone on in Java; hence the new views which were thus imported, with such a great momentum behind them, naturally soon succeeded in establishing themselves in the East. The watchword of the party of progress was no longer "Improvement," but "New creation" or "Radical change." The result of this movement was that a good deal of power and influence passed into the hands of those who knew neither the country nor its inhabitants. Now it seems to me to be a self-evident axiom that real improvement in the social condition of mankind can only be brought about by regular development, not by abruptly breaking with the past, sweeping away the existing order of things to make room for things that are still to be created, and precipitating the changes that, if ushered in along the path of steady developmental growth, would

consolidate themselves and avoid straining the laws of adaptation, as they gradually made their appearance. And this applies with special force to a country like Java, which has a vast native population, whose customs and manners are largely based upon a traditionary past of long continuance. In such a country the assumption of power by people ignorant of native life and native habits and thought, as well as the requirements and resources of the colony from the European standpoint—or if not ignorant of them, at least inadequately acquainted with them—is apt to lead to mischievous and even dangerous consequences.

But I must not dwell longer on these introductory remarks. I trust sufficient has been said to give the reader a clue to the comprehension of the actual situation at the present moment.

The topical questions just now current in the Dutch East Indies deal principally with two subjects, viz. the war in Acheen and the plantations, whilst in certain circles in the Netherlands still another question is discussed, viz. the art of extracting as much money as possible from the possessions in the far East.

The War in Acheen.—On this topic I need not say much. For an account of the history of the war up to 1884 I beg to refer to a paper I published in that year in the *Münchener Allgemeine Zeitung*.[1] Since then things have gone from bad to worse, and it almost seems as if there were to be no end to the entanglements affairs have got into in the north of Sumatra. It is as if some malignant spirit had been mischievously controlling events from the beginning of the war. From what has subsequently become known, the war might perhaps have been avoided altogether; but in 1873, and especially in the Indies, it was, I suppose, universally deemed necessary. At the time when fortune first smiled on the Dutch colours, after the *Kraton* had been taken in 1874, the Sultan of Acheen died, and there was then no one to negotiate with, hence it came to pass that the Dutch were obliged to annex the empire. Afterwards a combination of untoward events prevented a consistent policy from being adopted. But the worst stroke of all was the circumstance that the *Nisero* went out of her course to get wrecked on the Acheen coast, whilst the Dutch Government were compelled by the British Foreign Office to ransom the crew, who had been made prisoners by the natives, at a round sum, after the Dutch had failed to liberate them by force of arms, whereby great damage was done to Dutch prestige in Sumatra and the East. Accordingly, all the discontented and disaffected spirits in the north of Sumatra flocked together again, hoping that the English would come to their assistance and drive away the Dutch. Not that they had any particular predilection for the English; but the natives of the East Indies, like those of Europe, are fond of grumbling and complaining, and, when discontented, look out for any change, indifferent what it be, or whence it comes, whether from England, from Russia, or even from Turkey (for such, strange as it may seem, was the case at the beginning of the war against Acheen, when rumours were current among the inhabitants of the Dutch Indies that the Turks were

[1] 1884, No. 193, Beilage, and No. 194.

sending ironclads to the relief of their co-religionists in the north of Sumatra). But, as far as I understand them—and I think I do not speak without sufficient knowledge—to ask the natives of the Dutch East Indies whether they prefer the rule of the Dutch, of the English, the French, the German, or any other European government, would be much the same as asking an Englishman whether he would prefer to be put in the stocks, in the pillory, or to be publicly whipped. Thus, in some respects, owing to the action of the British Government, a sort of premium was, as it were, offered to all who could contrive to kidnap Europeans; at least, more than once the Achenese have again tried on the same practice for the purpose of embroiling their enemies with European Powers.

But the greatest misfortune of all, which indeed made the outlook hopeless, overtook the army. A few years ago the troops were attacked by *berri-berri*, a sickness that was not unknown before, but had never afflicted the army to any serious extent, or weakened or debilitated its strength, as is now the case; previously it was almost entirely confined to the convicts. In its latest development it has spared neither Europeans nor natives; no condition in life secures immunity from it; officers as well as private soldiers, and men and women alike, fall victims to it. I reproduce here from the *Indische Gids* (July 1888) a tabular statement based upon good authority, of the losses which the army has sustained from *berri-berri* during recent years :—

	Deceased.		Rendered unfit for service.	
Year.	Europeans.	Asiatics.	Europeans.	Asiatics.
1878	3	291	...	61
1879	7	359	...	56
1880	3	218	3	103
1881	2	190	2	124
1882	1	158	5	188
1883	4	235	13	188
1884	4	248	10	832
1885	54	662	57	1407
1886	114	433	207	626

Add to this the number of prisoners condemned to hard labour who die from the disease—a number, however, which cannot exactly be estimated. In 1886, out of an average of 816 (in Acheen) 337 died; in 1885, when the average number was 1602, 1265 died.

But, confining myself to the army, the figures quoted indicate a serious loss for an army which is but 29,779 men strong, among whom are 13,837 Europeans. But what makes things still worse is the circumstance that the invalid soldiers have to be granted a long period of rest, and for that time are altogether incapacitated for service, whilst a large proportion of them are travelling backwards and forwards between the

garrisons and the sanitaria, and therefore a large fraction of the men are rendered unavailable for active campaigning. The *berri-berri* "bacillus" is reported to have been found, but whether the discovery will result in much good being done, I know not, though it seems the situation has improved. The medical practitioners are reported to have resorted to the application of electricity, and apparently not without success. Strange to say, among the few garrisons which were not invaded by *berri-berri* in 1886, were Tjilatjap, Rau, etc., which bear an ill-fame for malaria.

ARMY.—I may perhaps pause here a moment to add a few words on the army and navy. Of the number above mentioned, and confining my remarks to those below the rank of commissioned officer, 13,837 were, as I have said, Europeans. Besides these there were 86 Africans, 1599 Amboinese (who are dealt with to all intents and purposes as Europeans), and 14,257 natives of the East Indies. Moreover, there were 188 other Europeans at the depôt, in the prisons, etc. Of the total of 14,025 Europeans—

7805	were natives of the Netherlands.	436	were natives of Switzerland.
1348	„ „ Eurasia (among whom 1097 half-bloods).	481	„ „ France.
		220	„ „ Luxemburg.
1193	were natives of Belgium.	166	„ „ other countries.
2376	„ „ Germany.		

The number of commissioned officers amounted to 1389; among them were—

1066	natives of the Netherlands.	3	natives of Belgium.
240	„ the Dutch East Indies.	1	„ Switzerland.
56	„ Germany.	1	„ France.
22	„ other countries.		

(These figures indicate the numbers in actual service; the nominal strength amounts to a little more; but the difference is too small to be worth mentioning.)

Besides the staff, the army was composed of 18 battalions of infantry (28 companies of Europeans, 10 of Amboinese, and 34 of natives), 4 battalions of depôt, 9 battalions and 4 companies for garrison duty, besides certain special troops for those who do not belong to the rank and file (*Subsistenten Kader*), recruiting depôt, etc. The cavalry consist of 5 squadrons, the artillery of 8 batteries of field artillery, 7 batteries of garrison artillery, and 8 batteries for the islands exclusive of Java (part of them with field-pieces). The engineers embrace the staff and 2 companies of sappers and miners, with some companies of labourers for fatigue work, and craftsmen.

It may be interesting to append a few figures taken from the *Koloniaal Verslag*, 1887, which will enable the reader to judge as to the mortality and general health of the army (Table A).

A.

Territory.	Nationality.	1882. Died.	1882. Strength.[1]	1882. Per cent.	1883. Died.	1883. Strength.[1]	1883. Per cent.	1884. Died.	1884. Strength.[1]	1884. Per cent.	1885. Died.	1885. Strength.[1]	1885. Per cent.	1886. Died.	1886. Strength.[1]	1886. Per cent.
JAVA AND MADURA. 1882—Bencoolen and Billiton included. 1883-86 only Billiton included.	European,	329	8,699	3·78	345	7,789	4·43	*b* 161	*b* 8,244	1·95	196	8,860	2·21	164	8,396	1·95
	African,	...	66	...	3	33	9·09	...	35	...	1	32	3·12	...	73	...
	Native,	199	7,016	2·83	322	5,992	5·37	*b* 210	*b* 6,659	3·15	162	6,222	2·60	128	6,026	2·12
	Total,	528	15,781	3·34	670	13,814	4·85	371	14,938	2·48	359	15,114	2·37	292	14,495	2·01
Acheen.	European,	98	3036	3·22	144	3022	4·76	138	3148	4·38	173	2193	7·89	192	1769	10·85
	African,	1	9	11·11	...	1	...	...	1	...	...	1	...	...	1	...
	Native,	121	2778	4·35	155	2958	5·24	219	3146	6·96	643	1997	32·19	426	1507	28·27
	Total,	220	5823	3·78	299	5983	4·99	357	6295	5·67	816	4191	19·47	618	3277	18·86
Islands exclusive of Java and Acheen.	European,	79	3614	2·18	101	3565	2·83	68	3482	1·95	84	3835	2·19	84	4,122	2·03
	African,	...	44	...	5	61	8·19	...	61	...	1	62	1·61	...	24	...
	Native,	109	4789	2·27	111	5475	2·03	100	6047	1·65	114	6055	1·88	85	6,167	1·38
	Total,	188	8447	2·22	217	9101	2·38	168	9590	1·75	199	9952	1·99	169	10,313	1·64
Total of the Dutch East Indies.	European,	506	15,349	3·29	590	14,376	4 1	367	14,874	2·47	453	14,888	3·04	440	14,287	3·08
	African,	1	119	0·84	8	97	8·24	...	97	...	2	95	2·10	...	98	...
	Native,	429	14,583	2·94	588	14,425	4·08	529	15,852	3·34	919	14,274	6·44	639	13,700	4·66
	Total,	936	30,051	3·11	1186	28,898	4·1	896	30,823	2·907	1374	29,257	4·69	1079	28,085	3·84

[1] Refers only to garrisons, and where military sanitary service was established (only very few exceptions).

The subjoined summary shows the number of men who were under medical treatment, and of those who died or became unfit for actual service (Table B) :—

B.

Year.	Under Medical Treatment.	Recovered.	Died.	Unfit for Active Service.	Deceased. Per cent. of the number of.		Unfit for Service. Per cent. of the number of.	
					Under Treatment.	Strength.[1]	Under Treatment.	Strength.[1]
Java and Madura, including Billiton, 1882 ; including also Bencoolen.								
1882.	38,038	34,324	528	1045	1·39	3·34	2·74	6·62
1883.	34,194	31,111	670	647	1·96	4·85	1·89	4·68
1884.	34,508	31,269	371	1230	1·07	2·48	3·56	8·23
1885.	34,507	31,228	359	1049	1·04	2·37	3·03	6·94
1886.	37,859	34,738	292	1057	0·77	2·01	2·79	7·29
Acheen.								
1882.	20,519	19,443	220	188	1·07	3·78	0·91	3·23
1883.	17,754	16,643	299	147	1·68	4·99	0·83	2·46
1884.	12,766	11,480	357	259	2·79	5·67	2·03	4·11
1885.	12,264	10,021	816	859	6·65	19·47	7·00	20·49
1886.	12,582	11,176	618	328	4·91	18·86	2·61	10·01
Islands, exclusive of Java.[2]								
1882.	19,894	18,691	188	199	0·94	2·22	1·00	3·41
1883.	20,980	19,688	217	243	1·03	2·38	1·15	2·67
1884.	23,595	22,510	168	206	0·71	1·75	0·87	2·15
1885.	22,767	21,153	199	573	0·87	1·99	2·51	5·76
1886.	24,464	23,370	169	190	0·69	1·64	0·77	1·84

From 1882 to 1886 inclusive, 201 died without having been under professional treatment, or were killed in the war, the numbers being 68, 35, 44, 29, 25 for the respective years. These figures should be added to the totals given in the table above.

The number of soldiers killed in the war, or who died from wounds, was comparatively small; it amounted, from 1882-1886, to 131 killed (among whom 71 Europeans and Amboinese), and 144 died from wounds (among whom 87 Europeans and Amboinese), moreover 7 commissioned officers killed, and 4 died from wounds.

Respecting other military undertakings apart from those in Acheen, there is nothing that calls for remark, at any rate in so far as actual

[1] See footnote [1] to Table A.

[2] Including a detachment in North Borneo (expedition).

fighting is concerned. And equally unimportant and undeserving of mention is the employment of the troops in the quelling of local riots in different parts of the East Indian colonial empire.

Navy.—The navy is composed of three classes :—(1) The East Indian navy—the vessels belonging to India, the officers and sailors to the Dutch navy; (2) the auxiliary subdivision, both vessels and crews belonging to the Dutch navy; (3) the navy of the Indian Government (not a military service), the officers of which are Europeans, whilst the sailors are natives.

On Dec. 31, 1886, the number of vessels in Class 1 numbered 21, and their crews 1747 Europeans and 722 natives; in Class 2, 4 vessels, 893 Europeans, and 154 natives; and in Class 3, 17 steamers, with 43 small craft, manned by 114 Europeans and 1172 natives. The vessels in the East Indies are soon worn out, and except those mentioned under Class 2, there are no modern warships. Of the Europeans serving in the East in warships in 1886, 27 died, and 186 were sent to Europe; of the natives 51 died, and 301 were incapacitated for active duty; whilst, owing to the ravages of *berri-berri*, 42 natives died, 75 Europeans were sent back to Europe, and 292 natives became unfit for service. Recently, proposals for fortifying the harbours on the north coast of Java have been under consideration, the existing fortifications in that region not being equal to modern requirements.

The commander-in-chief of the navy in the Dutch East Indies acts in subordination to the Governor-General, but at the same time he is, in some respects, subject to the control of the Naval Department in the Netherlands; from this ill-defined distribution of authority great inconvenience sometimes results.

Plantation Systems.—It is not only because the plantations form the principal topic of the day that I mention them in the first place, but because they are the real *nervus rerum* of the Dutch East Indies. I will endeavour to present a general view of them as they exist at the present moment in Java, limiting myself in the case of other islands to a few incidental remarks. As in their case the agrarian system is conducted in a different manner, it would be impossible to describe them without entering into details that would extend this paper to an undue length.

In Java three kinds of planters may be distinguished, viz. (1) the Government, (2) private planters, (3) the native agriculturists.

1. As I have already observed, the Government disposes of the ground, and has a right to the labour of the natives, at least in the coffee gardens, and, till 1890, in a few sugar plantations; in the cinchona plantations the people are not compelled to work, but are paid in proportion to what they do. According to circumstances, a certain number of families are selected and charged with the planting of the coffee trees, and have imposed upon them the obligation to keep the gardens in an efficient state of cultivation, to gather the ripe produce, and to deliver it at the magazines; for all this they are paid in proportion to the quantity they deliver at the rate of fl. 14 per picul;[1] besides this all the risks of culti-

[1] 1 picul = 133⅓ lbs. avoir.

vation have to be incurred by the natives; moreover, coffee trees do not generally bear fruit before the fourth or fifth year after they are planted. Of late, new regulations have been made, whereby the natives are allowed (subject to certain restrictions) to abandon the existing plantations and plant wherever they think fit, provided they always have a certain number of trees in the ground. Before proceeding to discuss the particulars, I will state the results. In 1886, 474,242 families were engaged in this industry in the manner indicated. There were, at the same date, about 135 millions of trees in the Government gardens; how many trees in addition planted by natives is not stated; in 1883 there were 131 millions under this latter category; let us say, therefore, there were altogether 266 millions, or for each family, on an average, 560 trees. The produce was:—

Year.	Piculs.	Per Picul.		
		Cost.	Net Return.	Profit.
1882	1,025,216	16·66 fl.[1]	31·223 fl.	14·563 fl.
1883	1,081,919	16·86 „	33·317 „	16·457 „
1884	1,012,338	16·47 „	31·285 „	14·815 „
1885	500,571	17·29 „	27·690 „	10·400 „
1886	817,716	16·72 „	32·745 „	16·025 „
1887	254,058	?	?	?

Any allusion that may be made to Government sugar cultivation means that for certain factories Government is entitled to have, until the year 1890, sugar-cane planted by the natives. About these plantations I shall have something to say when speaking of the private planters.

The cultivation of cinchona was undertaken by the Government ostensibly for the purpose of creating a new industry that should be useful to the world and advantageous to the natives; but *tempora mutantur*, and it now seems that these plantations are being extended in area, in order that a greater profit may be obtained from their produce; at least, private planters complain bitterly of the competition of the Government. In 1885 216,359 kg.,[2] in 1886 268,849 kg., were gathered; for 1887 the quantity was estimated at 350,000 kg.

2. Private planters get what land they require under different systems of tenure—(*a*) The first is to rent it (with the sanction of the Government) from the natives; the planting work is done by their own labourers or by the natives from whom they have hired the ground. This is the method adopted more especially by sugar planters; 93 establishments had part of their land planted through the mediation of the Government, whilst 52 only dealt directly with the natives. In only a few residencies are there European tobacco planters; most Europeans engaged in the trade buy the raw produce from the natives and prepare it for the market; the quantity of tobacco acquired in this manner amounted in 1886 to 6,788,590 kg. The few rice-mills existing were for the

[1] 1 fl. = 1s. 8d.

[2] 1 kg. = 2·2 lbs. avoir.

greater part in the hands of Chinese. Eleven indigo factories (3 of which were in the hands of Chinese) produced, in 1886, 46,647 kg. of indigo; most of the manufacturers had the indigo planted by day workers. A small quantity of vanilla was planted by native chiefs, and also some tea, which was sold to the proprietors of the factories by the native growers, both in the Preanger Regencies.

(*b*) The most important plantations are those laid out on ground which the cultivators rent from the Government; in 1886 there were 571, of which 561, containing 223,551 bahu[1] altogether, are taken on a 99 years' lease. In 398 of these plantations one or more varieties of produce were planted, 25 were not plantations in the strict sense of the term or had been deserted, 147 were only just beginning. The following details (Table C) taken from the *Koloniaal Verslag* for 1887, although the best that are available, are not complete. In considering them it must be remembered that many of the plantations have not yet yielded any return, or the returns are not yet recorded, whilst some of them grew more than one kind of produce :—

C.

Year.	Coffee.			Cinchona.			Tea.			Tobacco.			Sugar.		
	a	*b*	Piculs. *c.*	*a*	*b*	kg. *c.*	*a*	*b*	kg. *c.*	*a*	*b*	kg. *c.*	*a*	*b*	Piculs. *c.*
1884.	262	193	199,686	104	24	208,232	26	23	1,879,696	17	16	337,607	11	9	113,936
1885.	268	191	166,937	110	29	269,223	24	21	1,847,399	16	15	298,937	10	8	108,453
1886.	274	213	225,200	121	40	633,882	28	23	2,527,984	15	15	212,217	9	7	124,285

a number of estates.
b number of those which yielded the quantities *sub c.*

Native labourers get from 0·20 to 0·50 fl. (4d. to 10d.) a day as wages, and if working by the piece they sometimes earn 0·75 to 0·80 fl. (1s. 3d. to 1s. 4d.) a day.

(*c*) Considerable tracts of land were sold to private persons, especially in the beginning of this century, under the government of Daendels and of Raffles; the proprietors of which acquired at the same time some portion of the rights of sovereignty in connection with them; more especially the natives who live on these estates are under the obligation to pay certain taxes and dues, to render statute labour (but not in the plantations), etc. There were, in 1886, 121 estates of this class (area 1,140,219 bahu, 775,418 inhabitants, and having an estimated value of about 30,000,000 fl.) in the hands of Europeans; 229 estates (area 418,196 bahu, with 524,148 inhabitants, and an estimated value of about 24,000,000 fl.) in the hands of Chinese; and 55 (area 24,215 bahu,

[1] 1 bahu = 1·75 acre.

66,296 inhabitants, estimated value about 2·7 millions of fl.) in the hands of natives, Arabs, etc.

Of the rice, the staple crop of native agriculture (area planted in 1886, 292,408 bahu), usually one-fifth of the yield has to be handed over to the proprietor; the colonial produce amounted in 1886 to 100,054 piculs of sugar, 27,385 piculs of coffee, 823,642 kg. of tea, 139,000 kg. of cinchona bark, together with 16,000 kg. of tobacco, a little cocoa nutmegs, vanilla, etc.

(*d*) In the territories of the so-called "independent princes of Java," the Susunan of Surakarta and the Sultan of Jokjokarta, certain tracts of land are let to European planters; the number of these plantations in Surakarta was, in 1886, 127, and in Jokjokarta 50. The produce in 1886 was—

	Surakarta.	Jokjokarta.
Sugar, piculs,	419,697	629,570
Indigo, kg.,	346,034	217,648
Tobacco, kg.,	639,977	34,813
Coffee, piculs,	20,823	52

Moreover, there were 3 sugar establishments and 3 indigo factories (managed by princes, who were also proprietors of the estates on which the raw material was grown), which turned out, in 1886, 28,062 kg. of indigo, and 59,733 piculs of sugar. The natives living on the estates let to European planters are obliged to work for them, though not in the plantations or in the teak forests.

3. In the dominions of the Government, in 1886, 3,586,616 bahu were planted by native husbandmen, and of this area nearly one-third was cropped twice in that year; the area devoted to native agriculture thus came to about 4·8 millions of bahu (or about 8 millions of acres), and of these 2·8 millions were sown with rice, whilst the bulk of the remainder was set apart for food-crops (maize, etc.), 1·6 millions, and therefore only a very small part, being reserved for strictly colonial produce.

The cultivation of rice being by far the most important crop for the natives, I will dwell on it a little longer. The harvest, in the residencies under the direct administration of the Government, yielded a total of about 70 million piculs of paddy (rice in the husk), or about 25 piculs per bahu; the highest price made by the rice was 9 fl., and the lowest 1·10 fl. per picul, the difference between the highest and lowest prices in the same month being from 7 fl. down to 1·20 fl. The great differences of price reported from different residencies show plainly that in some of them there is very great room for improvement in the means of communication. We shall see later on that the annual production of rice is not sufficient for the native consumption; nevertheless a considerable quantity is exported (46,000 tons in 1886, 70,000 in 1887) to Singapore and China. It is unquestionable that if the natives bestowed greater care upon their rice plantations a larger yield could be obtained; yet they seem reluctant to adopt improvements of their own free will, and the European officers have apparently too much other work to do to be able to superintend the introduction and initiation of more improved methods of

agriculture among the native cultivators; this at least seems to be the necessary inference to be drawn from the *Koloniaal Verslag*, 1887, p. 157. The same neglect and indifference, and the same backwardness, on the part of the native husbandmen, is likewise extending to other branches: *e.g.* we learn from the same *Verslag* that in some residencies the planting of bamboo had to be *encouraged* (*id est*, orders had to be given to plant it), because the supply had diminished to such an extent as not to be sufficient for the ordinary daily requirements.

In Java the teak forests belong exclusively to the Government; but they are managed by private persons working under contract. Great attention is also paid to other forests in which timber grows: they are not entirely left to the natives to dispose of as they choose, and in some parts, where too much wood has been cut down, young trees are systematically planted on the ground thus cleared.

In 1886 the live stock in Java numbered 2,483,991 buffaloes, 2,046,111 cattle, and 517,629 horses. There were also 20,408 vehicles for persons and 82,750 carts for the transportation of goods.

On the other islands there are comparatively few plantations belonging to the Government or to planters cultivating on a large scale. The most important plantations are those of the east coast of Sumatra (in Deli, Langkat, Serdang, etc.). They were laid out 25 years ago, and now number about 200; some 50,000 coolies are engaged as labourers on them, and the crops were valued in 1886 at about 32,000,000 fl. On Sumatra's west coast the produce of the coffee gardens was comparatively small; the Government return being set down at about 48,000 piculs, and that of private planters at about 7000 piculs (1886). In Celebes (Mangkassar) the coffee plantations yielded in 1886 about 130,000 piculs; in Menado (north of Celebes) also the Government own some coffee plantations, which in 1886 yielded about 23,000 piculs, besides 12 plantations belonging to private Europeans. In the Moluccas there are many European planters, most of whom do not farm on a very large scale; a company on the little island of Batjan does not seem to be altogether prosperous.

It is a known fact that the falling-off in the prices of some colonial products, especially of coffee, and later of sugar, tea, and cinchona, has done much injury to the planters in the East Indies, and in Java their distress has been increased by the *sereh* disease, which attacked the sugar-cane; in consequence of the ravages caused by this disease, fresh cane will, it seems, have to be introduced into the islands. The deplorable plight of the planters awakened the pity even of the Government, who, by granting them a respite in the payment of their rents, etc., by lightening their taxes, and by allowing new cane-cuttings to be carried free of charge on the Government railways, earnestly endeavoured to assist them out of their economic difficulties. On the other hand, many useful improvements were introduced, and were it not for the *sereh* disease I believe that Java sugar (like cane sugar in general) would open up a severe competition with beet-root sugar. The coffee-planters have suffered to a considerable extent from a disease which assailed the leaves; and though the prices have been better of late, the yield, especially in 1887, was very small.

Now, prior to the time when circumstances darkened their prospects, the planters generally lived for the greater part on a scale of somewhat princely expenditure and in grand style, for the purpose of maintaining their position in the eyes of the natives; moreover, they thought it beneath their dignity to look after the small profits, but bent all their crowded energies to reaping them wholesale; other circumstances that have influenced their situation and standing I have indicated in the introductory remarks to this part of my paper. Then again many of those to whom capital had been advanced on loan failed, and had to abandon their enterprises. To show how disastrous the consequences were, I may state here that, according to a paper by Mr. N. P. van den Berg (vid. *Koloniaal Verslag*, 1887), the shares of all companies in the Dutch E. Indies that had been valued *medio* 1884 at an aggregate total of 101,312,186 fl. showed a loss of 27,692,597 fl. by the end of 1886. Those companies that were founded after 1884, and some others floated in the Netherlands, have fared almost still worse; they own a total capital of 44,118,455 fl., on which the loss, up to the end of 1886, was 17,674,453 fl. It is to be hoped that those planters who have been able to weather the storm and the successors of the unsuccessful ones will come out "wiser and better men"; but for the natives, as we shall see afterwards, the consequences are extremely serious.

Industry.—About industry *eo nomine* not much can be said. The chief mining produce is tin; the export of which for the last ten years amounted to :—

Year.	From Government Mines.	From Private Mines.
1877	4,133,166 Kg.	3,413,001 Kg.
1878	6,663,980 ,,	4,011,657 ,,
1879	4,716,055 ,,	4,414,908 ,,
1880	5,446,042 ,,	4,616,740 ,,
1881	5,356,690 ,,	3,969,030 ,,
1882	3,976,648 ,,	4,520,792 ,,
1883	4,232,779 ,,	3,773,675 ,,
1884	5,065,179 ,,	4,144,776 ,,
1885	3,625,440 ,,	4,367,638 ,,
1886	3,877,261 ,,	4,100,084 ,,

The tin comes chiefly from Banca (Government mines) and Billiton (mines belonging to the Billiton Company); moreover, grants are given in Siak and the environs to private persons. Grants for coal-mining have been conceded in Java and Borneo. Of other branches of mining industry I may mention petroleum-boring in E. Sumatra; gold, silver, and platinum mining in Borneo; gold, silver, copper, and lead mining in W. Sumatra, and some more. An unusual enterprising spirit seems to have taken possession not only of Netherlanders but of foreigners, for they still continue to prospect energetically for minerals. As for their success up to the present moment not much can be said.

To complete this review, I may state that in all the Dutch East Indies there were in 1886, exclusive of the manufactories belonging to the sugar, indigo, tea, etc., plantations, 133 industrial establishments, of which 38 were printing offices. Among them we find works for the manufacture

of ice and of machinery, besides a few minor industries, and one which is of rather recent date in the Indies—a brewery. Of all these establishments only a few employed as many as fifty hands. The results do not seem to have been very promising, to judge from the reports made on them in the *Koloniaal Verslag* (1887). The brewery is the only establishment the success of which is adjudged to have been "very good"; another, the "gas-works," got the qualification "good"; but with respect to the rest silence is the best encomium: "sufficient" is the highest premium of praise any one of them obtains. The wages of day labourers varied from 0·25 fl. to 2·50 fl., and from 7·50 fl. to 250 fl. in the month.

Communications.—The most important agent for the development of a country is good means of communication, and for a colony those which connect it with the mother country are also of great importance, though I do not wish to say that too much or too rapid intercourse with her is in my estimation precisely the thing that a colony wants. Now, with respect to the frequency of intercourse with Europe, the Dutch East Indies have no grounds for complaint, seeing that they are regularly visited by Dutch, English, French, and German mail steamers, in addition to other steam and sailing vessels; Java is also connected by cable with Europe and with Australia, and from there with the whole civilised world. In the rest of the Dutch East Indies things are not so satisfactory: Sumatra alone has telegraphic connection with Java, and on those two islands some 90 telegraph offices have been established. Another cable is, however, now being laid to Celebes *viâ* Bali; but the other islands enjoy no such advantage. The gross revenue of the telegraph department amounted to about 500,000 fl. in 1886.

The railways, in so far as they are in working order, are (besides a short line in Deli) all in Java, and belong partly to the Government, partly to private companies.

In the Year	Their Length was	The Gross Revenue amounted to
1877	266 Kilomètres.[1]	fl. 3,042,012
1878	350 ,,	,, 3,305,929
1879	379 ,,	,, 4,095,525
1880	411 ,,	,, 4,234,620
1881	527 ,,	,, 5,344,126
1882	604 ,,	,, 6,067,342
1883	699 ,,	,, 6,795,282
1884	924 ,,	,, 8,147,945
1885	932 ,,	,, 7,797,834
1886	938 ,,	,, 7,731,922

The railways opened or in process of construction in Java do not yet extend over the whole of the island; a line in Sumatra from Padang to Brandewijnsbay is now in process of construction. Though the railway system is not yet by any means sufficiently developed, it would be more useful if, in the first place, the lines were not under different managements, and, in the second place, if the tariffs were not so high. In some parts the

[1] 1 kilomètre = ·621 Engl. mile.

carts of the planters carry the produce to the harbours on a road that runs closely parallel to the railway. Steamship communication in the Archipelago is, when the current contract expires, to come into the hands of a Dutch company; this policy of taking the steamship communication out of the hands of an English company to make it a national affair will cost the Government dear.

I may now pass on to the third part of my labour, which by some people in the Netherlands would be considered the most important, viz.:—The methods by which profit is made out of the Dutch East Indies by the Government; at the same time I shall have something to say about the tax-payers, especially the natives and their economic condition.

(*To be concluded.*)

ON THE TRAVELS OF IBN-BATÚTAH.

By Professor Paul Chaix, of Geneva,

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Abú-abd-Allah-Mohammad, otherwise designated Ibn-Batútah, was born in 1304. He left his native town of Tangier but poorly equipped, and entered Tunis in a destitute condition; shortly afterwards, however, he went as khádi of a caravan on the pilgrimage to Mecca.

His descriptions of the Egyptian cities are puerile. He sailed up the Nile to Edfû, traversed the desert to Aïdhab, and was only prevented from crossing the Red Sea by the hostility of the Nubians.

His second journey from Cairo took him to Jerusalem and Damascus. His account of the latter city—no longer a residence of the Khalifs—refers to the numerous holy men in office, and to the absurd traditions grafted on the Holy Scriptures by the Moslims.

At last he entered, with the pilgrims, the holy city of Mecca. He left it by the road built by the Sultanah Zobeïd, the wife of Hârún-al-Rashid, and reached Kerbela, the shrine of Hosein, and paid a visit to the monastery of Wâsith-Riwâh, the residence of thousands of fakirs. He was, he says, impressed by the sanctity of their worship. After three hours spent in prayers, large fires were lighted, and the naked fanatics rolled themselves in the still burning embers. He saw Basra decayed, and found Susiana in the same state of misrule, under the sway of the Atabeks, as Sir Henry Layard found it after their fall.

Ibn-Batútah gives a sympathetic description of the march of a Mongol Khân from Baghdad to Tabriz and back, with his four *katúns* (wives), and a pompous mixture of warlike array and luxury which calls to our mind the march of Darius to the field of Issus. A journey through Mesopotamia kept him occupied until he made from Baghdad a new start for Mecca. He stayed at Mecca three years, engaged in devotional practices, which Mohammadan tenets permit to be fulfilled by proxy on behalf of paying patrons. He twice crossed the Red Sea to Suakim,

and gives an exact description of the country of *Yaman*, without, of course, mentioning the coffee, which did not come into use before 1475.

From Aden—then in full commercial prosperity—he embarked for Mukdisha, Mombasa, Kilwa, and, landing again at Zhafar in Arabia, visited the interior of Oman. From Ormúz he reached Shiraz for the second time, and then by way of the Persian Gulf and the pearl fisheries of Bahraïn he went to Mecca for the third time. He had then been travelling for seven years, and had successfully crossed the Red Sea to Aïdhab, and the desert to the Nile and Cairo.

This third visit to Egypt was followed by a second one to Syria. He travelled through many provinces of Asia Minor, from Satalyah to Sânûb (Sinopus), living sumptuously at the expense of hospitable and wealthy learned men, and of petty Turkish princes. He spent the Ramadân with the Sultan of Egherdir, listening every night to the reading of the Súrats of the Qorân, "delivered by beautiful and mellow voices which took hold of the soul, humbled the heart, shook the body, and drew tears from the eyes."

In the next page our tender-hearted devotee comes to Smyrna, and there purchases for 40 dinârs a beautiful Christian slave-girl—a class of merchandise which was, at the time, made plentiful enough through the pious inroads the Sultan Orkhân repeatedly made into the Christian provinces, so that Ibn-Batútah shortly afterwards crossed the Sangarius with a bountiful stock.

From Sânûb (Sinopus), Ibn-Batútah crossed the Euxine to Kerch, in the land of Kiram (Crimea), and was provided with a cart and a young slave-girl—his property—on his repairing to the court of the mighty Mongol Khan Mahommad Úzbek, a descendant of Chinghiz-Khân. He found that gouty monarch encamped, for the sake of the mineral waters, at the Besh-Tow (five mountains), an offshoot of the Caucasus, still preserving the Russian name of Petigorsk (five mountains). Here our traveller was courteously welcomed. He gives us at considerable length a picture of the ceremonies of that nomadic court, and ascribes the frequency of the gout among those barbarian conquerors to the dissolute life they indulged in.

Among the four principal wives of the Khan was a Greek princess, Palæologai, a daughter of Andronicus III., the Emperor of Constantinople, who took Ibn-Batútah into her retinue during a visit paid to her parents, and gave him, on this lengthened stay, a full opportunity of making a complete survey of that capital. It is interesting to read from the pen of a Mohammadan eye-witness a description of that still magnificent, if not flourishing, capital at a time of its approaching fall. He says: "The population is mostly composed of monks and priests, and its churches are innumerable. That of St. Sophia was built by a son of the maternal aunt of Solomon," but, for all its magnificence, it was desecrated by the number of idols, which prevented the rigid Musalman from entering its portals.

Ibn-Batútah experienced intense cold on his return to the steppes of Russia. In the following of the court he visited Astrakhan, the neighbouring populous capital of Sarai, now erased from the map, accompany-

ing the Khân in his usual northern tour to the old city of Bolgari, the former cradle of the Bulgarian nation; but he was deterred by unfavourable accounts from pushing further north to the *Land of Darkness*.

Loaded with the favours of Mohammad Usbek and of his queens, our parasitical holy man, in search of others, crossed, in forty days, the deserts intervening between Astrakhan and Urgenz, the former and now deserted capital of Khwârazm. He describes Samarqand and Bokhara as in a state of decay, the result of Chinghiz-Khan's bloody conquest. He found, by unblushing mendicancy, the means of spending in affluence two years at the court of another scion of the family of Chinghiz-Khan, who ruled over Chaghatâi or Turkistan.

Bent upon reaching the far-famed empire of Hindustan, Ibn-Batútah crossed the Hindukush, the river Indus, and was detained two months at Multan, awaiting the pleasure of the Sultan of Dihly. He entered that city (then already the magnificent capital of a state quite as extensive and powerful as the Mogul empire was two centuries later) "on the first day of the divine month of Muharram" (the 12th of September 1333). Dihly was surrounded by walls pierced with twenty-eight gates, and of such enormous thickness (eleven cubits) that barracks and military stores were constructed in it as in the walls of Carthage, as described by Polybius. Since the Mohammadan conquest of Dihly, in 1188, its former extent had been largely increased. The great mosque had been built by Sultan Moizz-ad-dîn on the site of a pagan temple, and, in order to humble the religious feelings of its former worshippers, the entrance of the new shrine had been placed over two colossal bronze idols. Its extent was very great, and it was crowned by a colossal minaret, built of a red stone, with an upper story of white marble crowned and ornamented with gilt spheres. But another minaret, destined by the Sultan Qutb-ad-dîn to throw this marvel into the shade, was left unfinished by the death of its founder; it was designed on such a scale that three elephants might walk abreast up its inner staircase. The pages of our traveller contain endless descriptions of the monuments, pleasure-grounds, and palaces of the imperial court.

Ibn-Batútah, in the middle of so much pageantry, feasting on empty hopes and profuse adulations, was, from the time of his leaving Bokhara, hunted about by merchants to whom he was in debt to the amount of 55,000 gold dînars. His machinations at the imperial palace, however, at last overruled the treasurer's opposition, and the Sultan, Mohammad Shah, generously paid his debts and conferred upon him the high dignity of Qâdhi of his capital—for which he seems to have been but ill-qualified—with an income of 12,000 dînars, and an additional bounty of equal amount, "as he was," said the donor, "a man of lavish expense." Indeed he was.

Mohammad Shah, having ascended the throne through parricide, was the more eager to testify his false devotion towards his murdered father by the erection of a mausoleum of unparalleled splendour. Ibn-Batútah, who was for years intrusted with the direction of the work, erected on the mausoleum a tower of 100 cubits; he attached to the establishment 150 readers and 80 students, in order to secure a continuous daily repe-

tition of the whole Qorân. There were, besides, 460 servants, and a daily allowance of food was made to the faqirs. But he lost the favour of the Sultan, probably on account of his mismanagement, and, resorting to his usual show of ostentatious austerity, he gave to the poor all his worldly property and withdrew to the retreat of a renowned Shekh, whose austerities he shared in for months, and with complete success. The Sultan, relenting, sent him with presents to the Emperor of China; and his journey across Malwa and the Marâtha country is described with particulars that allow us to follow him on the map as far as the harbour of Kolam (Quilon) in Travancore, where a shipwreck put an end to his mission. A thousand sailors and soldiers were embarked on the enormous junk which was to have carried the embassy and presents to China.

In a state of absolute destitution Ibn-Batútah tried his fortunes in the Maldive Islands. He describes them in words which might even now be a faithful picture of the archipelago. With his usual fortune he was kindly received by the modest lord of the isles, provided with the office of Qâdhi and a numerous harem, among whom was an aunt of the Sultan. His rule was brought to an early close on account of its tyranny. He broke up his family establishment, and sailed for Ceylon. He piously performed a pilgrimage to the summit of Adam's Peak, was again wrecked on the Coromandel Coast, and visited the Sultan of Arcot, where the plague was raging. Forty-three days of sailing brought him to Bengal. He ascended the river Brahmaputra to the land of Assam; then he visited the Andaman Islands, the hospitable Sultan of Samatrah (Sumatra), Java, Tongking, landed at Zeïthûn in China, and passing along the Imperial Canal, reached the eastern goal of his wanderings, Khanbaligh, the Mongolian Peking, of which he gives a faithful description.

On his return from the harbour of Zeïtûn, he visited, for the second time, the court of Sumatra, Kolam in Malabar, Zhafar, Muscat and Oman in Arabia, Ormuz, Shîraz for the third time, Baghdad and the venerable shrines in Irak, and found himself again, after an interval of twenty years, at Damascus, where he learned that death had freed him of his divorced wives and abandoned children. The "great plague" was then (June 1348) raging, and carried off in one day 2100 of the Damascene population, hundreds at Jerusalem, Emesa, Gaza, and thousands at Cairo. Here we read again the mention of a third journey up the Nile, of a successful passage from Aïdhab to Jidda, and a fourth Ramadân spent at Mecca in pious fasting.

On his last return from Mecca, Ibn-Batútah again saw Medina, Jerusalem, and Cairo, and reached Marocco, his native country, after landing at Tunis and Sardinia. There he met his own sovereign, to whose praises he devotes ten pages of shameless flattery. He then indulges in a prosaic enumeration of the cheapness of all kinds of victuals, salt and fresh butter, fruit and mutton,—a powerful incentive to his sentimental but somewhat blunted patriotism. He nevertheless paid a well-deserved tribute of admiration on his visit to Granada, which the Castilian arms had not then wrested from the hands of the weakened Arabs. In company with the *Illustrious Stirrup* (the Sultan) he saw Marocco, already falling to ruins, and followed him to Faz.

At a time when he might have indulged a well-deserved rest, our traveller suddenly started across the desert, from west to east, finishing up with an exploration of the empire of Mally on the banks of the Niger.

By command of the Sultan, Ibn-Batútah undertook to give a written account of his travels. In this he displays great powers of observation and memory, allied with the most contemptible morals. The work was finished, with the collaboration of the Sultan's secretary, who died in 1356, or eight months after the completion of the work; but the traveller ended his meritorious career and holy life in 1378, at the good age of seventy-four.

THE WESTERN SAHARA, BETWEEN THE TROPIC OF CANCER AND THE WADI DRAA.

By W. Scott Dalgleish, M.A.

To the *Revue de Géographie* for April M. Camille Douls has contributed a minute and interesting account of his recent adventurous journey in the Western Sahara, between the Tropic of Cancer and the Wadi Draa. M. Douls' explorations have furnished geographers with much new and valuable information regarding that region and its inhabitants. He has given detailed descriptions of the surface of the country—its dunes, its wadies, its gorges, its hills, its oases. He has corrected the mistakes of Panet regarding the position of the *Sebkha*, or lagoon, of Zemmûr, and the source of the Sagîat-el-Amra, or Red River, the latter of which points he has definitely settled.

M. Douls tells his story modestly. It is an editorial note, and not his article, that informs us of the hardships he encountered. He entered the country, between Cape Bojador and the Rio de Oro, in the disguise of a Musalman; but having fallen into the hands of a party of the terrible Ulad-Delim — the scum of the Western Sahara — he was despoiled, ill-treated, laden with chains, and thrown into prison, where he remained for ten days. He owed his life to the Musalman prayers which he recited at critical moments. Fortunately, a Hadji thought he recognised in him a co-religionist, and befriended him. Having been released, he was treated as a brother by these Bohemians of the Desert, and was accepted as a fellow-traveller. But his misfortunes were not yet over. On reaching Southern Marocco at the end of his journey, the Sultan, incensed at the discovery that a European had traversed his dominions, caused him again to be put in irons; and he was released only on the intervention of the British Minister, Sir Kirby Green, and of Mr. Ferguson, the Secretary of the West African Company.

Having sailed from the Canaries, M. Douls landed on the Coast of Garnet Bay, south of Cape Bojador. He found the coast, which trends southward from Garnet Cape, bordered with dunes of low elevation, varied with bluffs which are called *Jerf* by the Moors. The coast abounds with fish, especially sardines and cod, and is frequented on that

account by fishermen from the Canary Islands. Striking inland in a south-easterly direction, he found the surface rising gradually till it reached a height of 25 mètres. The ground was covered with a thick coating of sand, through which heads of rock rose abruptly. Here the vegetation was very scanty. After three days' journey, he came to a country undulating in the direction of the coast, with little water, and that water brackish.

At about 100 kilomètres from the coast, to the south of the 25th parallel, he found a short chain of low hills, lying north-west and south-east, and terminating in the south in two summits 60 mètres in height. From the base of these hills a valley stretches eastward formed of silicious soil, which is very favourable to vegetation. Advancing obliquely for 100 kilomètres towards the 24th parallel, he found oval depressions, which serve as receptacles for the rains of winter. The nomads who frequent the region, utilise these depressions for the cultivation of barley. Beyond these are steppes, bordered with slight hills, and covered with sand; and beyond that is the Great Desert. Still further to the south-east, between the 10th and 11th degrees of longitude, the Moors called his attention to a geological peculiarity of the surface, viz. heads of rock rising out of the sand in the form of obelisks or of needles.

Between the 12th and 13th degrees of longitude, the extreme limit of the range of the nomads is reached. In that region there is a longitudinal zone covered with sand-hills, serrated and difficult to pass, but intrenched with valleys, or wadies, clothed with tolerably dense vegetation, produced by the winter rains, and very serviceable for the support of the flocks of the nomads. These wadies are bounded on the south by the desert of Uran, and on the east by the Great Desert, properly so called. As M. Douls travelled with nomads who were in search of winter quarters, these wadies on the skirt of the desert formed the extreme limit of his journey toward the south-east. Then he found the *Juf*, a vast depression of the Sahara, fertilised by the winter's rains, and frequented in the season by immense numbers of hares and herds of gazelles, antelopes, and ostriches. It stretches from the steppes to the *Sebkha*, or lagoon, of Tawâdny, on the route from Tindûf to Timbuktu.

Turning northward with his nomad companions, M. Douls left on the south the Blad-el-Meurthir, which is frequented in winter by the nomads, who there find excellent pasture.

In his northward journey, M. Douls crossed the route of Panet, and was able to correct the error that traveller had made regarding the location of the lagoon of Zemmûr. Panet had never seen Zemmûr, and, trusting to false information, had placed it between the 25th and 26th parallels, whereas M. Douls found it to lie south of the 25th parallel, nearly in a line with Cape Garnet. The hill of Zemmûr, near the lagoon, is about 300 feet in height. Plants are rare in that region, but their aromatic flavour is very grateful to the camels.

After crossing two plains—the one grassy and fertile, the other very sterile—the traveller found himself once more in the region of Cape Bojador. There the geological structure of the soil changes. The sand is

pierced by rocks which, under the action of the elements, are reduced to fine powder. That accounts for the abundance of dunes between Capes Juby and Bojador, and also for the nomad custom of wearing veils to exclude the particles of sand, which are so fine that they penetrate the most minute interstices.

There are more dunes about Cape Bojador than in the surrounding country, owing to the winds that prevail there for the greater part of the year. One feature of the waste of the rocks is very curious. Large pieces of sandstone detached from the hills are rounded into a cylindro-conical form. Then the interior wears away until nothing is left but the outside envelope. The stones are then perfect cylinders.

The region around Cape Bojador is one of the best plains of the Western Sahara. There are many springs, and vegetation is abundant. The soil is mainly of quartz, and contains many pebbles. It presents the appearance of plains, with undulations parallel to the coast. In that region, called by the Moors *Kddâ*, numerous little oases of shrubs (*Grara*) are dotted over the plain. M. Douls counted as many as sixty in a single day's march within 30 kilomètres of the coast.

Going northward, parallel to the coast, he crossed a great plain with five or six tumuli (*Brurj*, in Arabic) which mark the tombs of ship-wrecked or murdered Europeans. In that plain many geographers place a river named the Belta. There is no such river. There is only a rush of water in the rainy season, which has the appearance of a river as seen from the sea.

Further north are the Matillos, high sand dunes running parallel to the coast, 100 kilomètres long, and more than 1000 mètres broad, with a height of 60 mètres. They are difficult to traverse, and are avoided by the nomads. They stretch from the mouth of the Sagîat-el-Amra to a point a little south of the 27th parallel.

The Sagîat-el-Amra (Red River) is an important river. At one period of the year it overflows and fertilises its banks, which are covered with little yew trees. At 180 kilomètres from its mouth, the river is dry during the greater part of the year, but the Moors are always able to obtain water by digging in its bed. M. Douls explored the basin of the river, first following the left bank, and then about the middle changing to the right. Beyond that he found extensive and very fertile plains, from which the Moors reap magnificent crops of barley. The river in its upper course flows south-west.

Quitting the river he went in the direction of the *Hamada* (plateau), a table-land of great extent, with a mean altitude of 300 mètres above sea-level. Its fertile slopes are covered with gum and other trees, and in winter with grass.

On the east of the *Hamada* stands Tindûf, the capital of the Western Sahara. It is but a small town, though in the eyes of the nomads it appears as a great capital. It was founded so lately as 1857 by Bel Hamedj, and it has grown rapidly. It stands in the middle of an oasis 395 mètres in altitude, remarkable for its temperate climate, and abounding with gardens filled with fruit-trees and vegetables. The houses are of dried clay.

Situated in the route of the caravans from the Sudan, Tindûf is superior to In-Salah in Twat, as the meeting-point of different routes going to Timbuktu. Five lines converge there—(1) from Wadi Nun, Glimin, and Mogador; (2) from Akha and Marocco; (3) from Tafilelt; (4) from Twat and Southern Algeria; (5) that of the eastern nomads, by the Sagîat.

Caravans from Timbuktu leave part of their merchandise, and nearly all their slaves, at Tindûf. Thus the Grand Akabar, which M. Douls found had brought 520 slaves of both sexes *en route* for Marocco, left at Tindûf 90, who were sold there, to be scattered over Northern Africa. Giraffe skins, camel-hair and goat-hair are also left there, because it does not pay to carry them further. Dates, also, are better and cheaper than at Wadi Nun.

There, also, the great caravan (Grand Akabar) is formed for Timbuktu, containing sometimes thousands of camels. It thus appears that Tindûf has already become a place of great commercial importance. Its houses have doubled in number during the last fifteen years. Most of the inhabitants are originally from Tekna.

From Tindûf M. Douls again travelled westward toward Cape Juby. It was then that he inquired into the question of the source of the Sagîat, about which there has been much controversy. The opinion he arrived at, after closely interrogating the nomads, is, that it has not a single source, but that it originates in numerous little lakes and streamlets lying to the south of the plateau El Hamada, which is north of the position assigned to the source by Panet.

M. Douls then traversed the Tekna and the territories of the Ulad-Mussa and the Ulad-Shkarna, all fertile and well tilled by the Moors. The oases are oval depressions, in which the winter's rains gather. At last he reached the lower basin of the Sagîat, in the territory of the Tidrarin, which is again desert, with dry and sandy steppes.

A small territory, about a day's march from Cape Juby, is called Tarfaya by the Moors; the natives call it *Dar Sbeira*.

Opposite *Dar Sbeira*, and north-east of the Sagîat, is the plain of Derua, in the middle of which a shelter for caravans has recently been constructed by the Duati, called Nzéla Duati.

A day's journey SSE. across the plain of Derua brings us, at the foot of a gorge 30 feet deep, to the Wadi Meltigi. The rainy season ought to send a current over its stony bed, but the Moors assured him that no water was ever seen there. Its bed does not reach the sea, owing to the structure of the land, to volcanic upheavals, and to the movement of the sand, which covers whole valleys.

Half a day's journey NE. from the Wadi Meltigi brings us to the Wadi Agoniet. Here again the plain suddenly sinks into an immense gorge, at the foot of which the sinuous bed of the river may be traced. The river-bed is dry, but the luxuriant shrubs show that the subsoil is moist.

A third gorge, half a day's journey further north, belongs to the Wadi Andermuss. Here again the river-bed is dry; but the Moors have only to pierce the clayey soil to get plenty of water. The sides of

the gorge are nearly perpendicular, and the bottom, which is 60 feet below the level of the plain, is covered with luxuriant vegetation.

At a day's journey north-east there is a fourth river, with a bed about one kilomètre in breath, and covered with vegetation. It is intersected by little streams of brackish water. The depression of this wadi is 80 feet below the plain.

Beyond another plain, intersected with hills and little valleys, the soil suddenly sinks, disclosing, at a depth of 100 or 120 feet, a magnificent valley, with perpendicular sides, in the midst of which the Wadi Gatara begins. This immense valley is continued to the sea; but the river, after winding through several kilomètres, loses itself in the sand. The caravans are accustomed to descend to the river to refresh their camels, but the water is insipid and rather alkaline.

Going southward toward the Wadi Nun, the route crosses a plain bordered by hills, the valleys of which are very fertile. These hills terminate in an immense group, grander than any of those described above with a greater depth than the Wadi Gatara, and opening into a valley many kilomètres wide leading to the Wadi Chebika. The gorge is bordered by eruptive rocks, peaks, passes, and high hills, assuming an infinite variety of forms. The bottom is traversed by a torrent, and its clayey soil gives rise to a wonderfully luxuriant vegetation. The gorge lies north and south, while the Wadi Chebika lies east and west. The Wadi Chebika is the broadest of all the valleys in this region. The bed of the river is hidden by shrubs, and it is bounded by granite hills.

What strikes the traveller in that region most forcibly, is the spectacle of these vast river-beds—the remains of majestic rivers which must have rolled their impetuous waters through a tropical vegetation in prehistoric times. There must have been great upheavals to dry up these rivers, and cut their courses by chains of mountains. Then, doubtless, settled populations lived on their banks, and perhaps at the places where the nomad now watches his flock villages and even towns may have stood in the midst of tropical luxuriance.

North of the Wadi Chebika, there is a long plateau, and then a succession of grass-clad valleys. This is the northern frontier of the nomad region.

One day's journey north of the Wadi Chebika, the Wadi Draa is crossed. The Draa is the most important of the rivers of the Western Sahara, because it is the only one that has a constant flow of water, because of the length of its course, and because it forms a natural barrier between the nomads of the desert and the settled tribes—between the Sahara and Southern Marocco. Its vast bed comprises many streams. The valleys are clothed with shrubs. The banks and the bed are of light alluvial soil, capable of great fertility if cultivated. But the river is not navigable, and when M. Douls crossed it in May, it was quite shallow.

After the Wadi Draa, the Wadi Nun is reached. There the surface has a different character—no more plains, but only mountains of primitive formation, which furrow the country in all directions. In the south, the soil is uncultivated and little capable of culture; and the only resource

of the people is the rearing of cattle. There are no villages, and the inhabitants dwell in tents.

The truly settled population is not met with till one goes a day's journey further north, and finds arable land. The first village one meets with is Ksar-el-Abiar, between the Wadi Draa and Glimin, the chief town in Wadi Nun. The town is built of clay, on the side of a hill. The only trees that break the monotony of the scene are a few Barbary figs. In the distance, between the mountain chains, one sees fertile valleys, numerous villages, and garden pasture. That is the Wadi Nun, and further off is the Sus.

M. Douls thus summarises the chief features of the Western Sahara: "There are vast plains, hills, mountains, valleys, and beds of rivers; but nowhere is the desolation so great that man cannot find the means of living. Certainly the nomad leads a precarious existence. I do not know that there is in the whole world a more sober people; but, at any rate, they do live there; and as long as the steppes continue to nourish their camels, they will live there, since they derive all their subsistence from the milk of that useful animal. In respect of mineral wealth, the Western Sahara appears to me very poor. Nowhere have I found such traces of minerals as one finds at every step in Southern Marocco."

GEOGRAPHICAL NOTES.

EUROPE.

Glasgow.—By the new boundary arrangements the area to be added to the city of Glasgow contains 8500 acres, which, in addition to the 6111 acres of the existing city, gives an area of 14,611 acres to the extended city. The population to be added is estimated at 180,000, which, added to the 543,995 of the existing city, gives a population of about 723,995 for the extended city.

It will be understood that these figures depend upon the recommendation of the Commissioners, who recently sat in Glasgow, being adopted by Parliament. Although the necessary bill has not yet been introduced, it will no doubt appear next session in connection with the bills for the reform of Local Government in Scotland; and it is not expected that, when introduced, it will meet with serious opposition.

International Geographical Congress at Paris.—The Paris Geographical Society is organising a Geographical Congress to be held in August of next year, at the same time as the Universal Exhibition, at Paris. Invitations to the Congress have been issued to all Geographical Societies, and will be extended to those who are interested in, or have contributed to, the progress of geographical science. There will be two classes of members: *membres donateurs* (fee 40 francs) and *membres titulaires* (fee, 20 francs). The Congress will be divided into seven sections:—(1) Mathematical Geography, Hydrography, and Topography; (2) Physical Geography; (3) Economical and Commercial Geography; (4) Historical Geography and Ethnography; (5) Scholastic Geography; (6) Voyages and Explorations; and (7) Cartography. Each Society represented at the Congress will be requested to appoint a reporter, whose function it will be to contribute a summary of the voyages, researches, and publications which most have contributed in the past 100 years to the progress of geography in his country. These reports will subsequently be printed, and should form a valuable volume

of reference. The Secretary of the Royal Scottish Geographical Society will be glad to receive the names of any members of the Society who may desire to be present at the Congress.

St. Michael's Island: Azores.—As a member of the third scientific expedition of the Prince of Monaco's yacht *Hirondelle*, M. Jules de Guerne visited the islands St. Michael and Fayal with the object of inquiring into their fauna. He was able to discover, what has hitherto been unknown, a considerable amount of animal life in the lakes, which, if not of great variety of species, abounds in sufficient quantity. The result of his investigations, together with some useful geographical facts, have been partially published in the *Compte Rendu* (No. 13, 1888) of the Paris Geographical Society.

ASIA.

Lake Balkash.—The explorations of M. Nikolski in the region of Lake Balkash throw new light on this vast sheet of water. The formerly accepted theory that in early geological times Lake Balkash was, like the Aral Sea, connected with the Caspian Sea, is not borne out by more exact investigation, as the elevation of the land to the west of the lake is of very great age, and is composed of Jurassic, Devonian, and other deposits. On the other hand, it is probable that Lake Balkash at no very remote time stretched much further to the east and connected with Lakes Sisik-Kul, Ala-Kul, and even the Ebi-Nor. The water of the lake, judging from its fish, was either sweet or slightly brackish. The steppes surrounding Lake Balkash at the present day present a clay soil in the north-west, covered in the spring with puddles of water, but in the south-east a sandy soil, rich in springs, up to a certain depth. From November to April the lake is covered with thick ice.—*Globus*, No. vi., 1888.

The Indian Railways.—From the Administration Report on the railways in India for 1887-88 just published, it appears that during the year ending March 1888, 988¼ miles of new railway were opened, giving a total open mileage in India of 14,383 miles, while the railways open and under construction amount to 16,870 miles. The most interesting new features are the opening of a system of military railways on the north-west frontier through extremely difficult country, the gradients in some places being 1 in 25; the commencement of a tunnel 2½ miles long through the Khojah-Amran range on the extension of the Sind-Pishin section, and the opening of the Southern Mahratta railway through the Portuguese territory to the sea at Margaon. A number of the mètre-gauge lines are being converted to the broad-gauge—5 ft. 6 in.—to assimilate them with the general system. Railway extension in Burma and Assam is being steadily carried on. The fuel employed is mainly native coal, wood, imported coal, and patent fuel, as the following table shows :—

Consumption of Fuel on Indian Railways.

Year.	Coal.		Coke.	Patent Fuel.	Wood.
	English.	Indian.			
	Tons.	Tons.	Tons.	Tons.	Tons.
1887	212,529	479,210	9564	30,029	292,808
1886	240,063	460,948	9132	26,212	259,513

Petroleum wells at Khatun, 40 miles from the nearest station of the Sind-Pishin section, in Baluchistan, have been examined by means of boring tools brought from Canada; they prove sufficient to supply all the locomotives of the section. As the oil is too viscid to flow readily through a gravity pipe-line, the question of transport is at present the chief difficulty in the way of introducing this fuel. At 31st December 1887 there were 1988 railway stations in the Indian Empire, and 225,057 railway employés, of whom 95·7 per cent. were natives. The number of persons killed on the railways was 429 in 1887 against 382 in 1886; but the injured were 691, instead of 758 as in the previous year. During 1887 the net traffic receipts were slightly lower than in 1886, although the amount of goods carried and the number of passengers showed a marked increase. A table of the 33 chief classes of goods carried concludes the report. The most important of these are:—grain, 3,972,000 tons; railway plant, 2,433,000 tons; coal, 1,684,000 tons; oil-seeds, 1,225,000 tons; and salt, 1,091,000 tons. The smallest item recorded is "Umbrellas, 495 tons."

A Naturalist's Expedition to Mt. Mulai in Tenasserim, and the Karen Ajain.—Good and honest work always deserves hearty commendation, and it is one of the functions or privileges of this Magazine to call its readers' attention to work of this description done in the field of geographical exploration and geographical observation. In this note we have to introduce the reader to a brave and energetic Italian naturalist, who is no less enthusiastic than he is persevering, namely, Signor Leonardo Fea, who has spent some four years of devoted labour in Burma. The July number of the *Bollettino della Società Geographica Italiana* contains a long narrative of a journey, extending over the first four months of the present year, undertaken by Signor Fea, from Moulmein to Mount Mulai (Moolaee Toung or Mooleyt), the southernmost culminating peak of the Dona Mountains, one of the chains that run from end to end of Burma. Along with an ardent love of the animal world Signor Fea possesses a power of lucid and picturesque description, which makes his reports very interesting reading, and shows itself in his pages in several exquisite vignettes descriptive of native life, animal life, and the scenery of Tenasserim.

The Dona Mountains lie parallel to the River Unduro (Houngdarau), which flows north, with an inclination towards the north-west to join the Hlaing-bhuai, the two together then constituting the Giain or Giain-Miit, which flows due west into the estuary of the Salwin, to the north-east of Moulmein. The first district visited by the traveller in the course of this expedition was the Farm-Caves, situated in a range of hills, whose flanks are broken up into fantastic pinnacles and towers, and seamed with rugged chasms and ravines, lying between Moulmein and the mouth of the Giain. The caves are three in number, and harbour several species of animals,—bats, birds, insects, etc. Passing over Signor Fea's account of his visit to these caves, which is mainly of interest for the naturalist, we come to his journey from the coast to the foot of the Dona Range.

His path ran for the most part alongside the River Unduro, through a country that was partly dense forest and partly open grassy plains. The river is of considerable breadth but shallow, and its bed is encumbered with islands and sand-banks; whilst its banks, at least in its lower course, are level and monotonous. Higher up, opposite the southern extremity of the Dona Mountains, it contains several rock-strewn rapids, and its banks are draped with an unbroken curtain of forest and green vegetation; its width in the same part is about 45 yards. At a place called Chiaitan, just south of 16° N. lat., and west of 98° 30′ E. long.,

Signor Fea left the river and struck inland almost due north, so as to ascend Mount Mulai by crossing its western flanks to its north side. The country then became more undulating ; the foot-hills of the range were steep and barren on their southern faces, but covered with verdure and trees, shrubs, ferns, and *Lycopodia* on their northern slopes. On the right of the path rose the mountain chain, clothed with thick forest. The path continued to rise steeply. The forest was succeeded by dense thickets of bamboos. On either side were profound abysses. At length the party reached the foot of Mount Mulai, which is only accessible from the north, and crossed a grassy undulating plateau, adorned with numerous thickets of rhododendrons with white flowers, gnarled oaks, and thick masses of parasitic plants creeping all over the trunks and branches, amongst which the most conspicuous were beautiful orchids with white and yellow flowers. The actual ascent shall be described in the traveller's own words (freely translated) :—"The northern slope of the colossal mass was covered almost up to the summit with a forest which at first sight seemed to be impenetrable ; but this idea soon changed when we entered it. Underneath this thick canopy the level ground, rising but slightly, was clothed with an uninterrupted carpet of grass, variegated in places with fragrant musk, a great variety of elegant ferns, beautifully festooned and clinging creepers, and shrubs of divers kinds, here disposed in little groves, there hugging the ground, and all entangled together. Modest begonias with dark green velvety leaves, growing on the rocks, contrasted strongly with the white tints of the surrounding lichens. The green carpet ascended up the hoary tree-trunks, and spread itself over their knotty boughs, whence it frequently hung down in fantastic fringes swaying to and fro in the peaceful breeze. The profound silence which reigned throughout the intense shade, scarcely broken by the chirpings of the little birds and the soft chatterings of the squirrels, had a solemn effect." The actual peak or summit (6300 feet), which affords just sufficient level ground for two small pagodas, places of pilgrimage to the natives of the valleys below, "like a triangular pyramid, whose northern face is covered with dense forest, has its two other sides rocky and bare and of a giddy steepness."

We have not space to mention the many interesting specimens of the plant and animal world which Signor Fea describes with loving minuteness. But we cannot refrain from adding some particulars about the native inhabitants of the valley that skirts the mountains on the west. They are Karens by race, and belong to a separate tribe called Ajain. "Their skin is of a brownish colour, but lighter in tint than that of the Burmese. Their eyes are oblique, their nose a little prominent, and the mouth normal ; the lineaments of the face vary somewhat, but in general are expressive of intelligence. The hair is without exception brown, and the eyes are of the same colour. The former is sometimes curly ; and the women wear it long and gathered into a knot on the top of the head. Amongst the men I observed differences ; some wore it long and tied into knots on the head, whilst others had it cut short and loose. This last fashion is that which is generally seen in the youth of both sexes. Their ears are small and well-shaped ; but the women wear earrings in the form of cylinders, which they pass through the lobe and so distort its shape. The men also have their ears bored ; but only one of them is deformed, which they delight to adorn with small bunches of flowers and leaves. The beard is close shaven ; in fact they are accustomed to have it pulled out, in the Burmese fashion, with small pincers. They are of ordinary stature, have well-proportioned limbs, and the women in particular can boast of small, well-made hands and feet. They speak a dialect different from that of the Karens, and possess no written books. They are of

nomadic habit, abandoning their settlements after every few years to go and build their bamboo huts elsewhere on the mountain flanks where water is obtainable. . . . Their religion seems to be a mixture of Buddhism and certain curious superstitions with respect to the *Natt* or spirits. They are said to cremate their dead." The marriage rites are of the most pristine simplicity; mutual consent and the consent of the parents being all that seems to be required. Signor Fea speaks highly of their intelligence, honesty, and general morality. Peace and harmony seem to reign unbroken in their villages, and considerable respect is paid to the village chiefs. The chewing of betel and the smoking of tobacco are habits common to all ages and both sexes alike. Rice constitutes their staple food, but they also cultivate various kinds of vegetables, bananas, pine-apples, and eat several different kinds of fruits that grow wild in the forests. Of animal food they do not use much; though nothing hardly comes amiss to their palates,—monkeys, rats, and squirrels being favourite dishes. The women weave on rude looms the coarse cloth of which their garments are made. Signor Fea also describes one of their festivals, called *puée*, which consisted principally of posture dancing, singing, and rude dramatic representations.

We may add that full details of Signor Fea's work as a naturalist will be found in the *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, vols. iv.-vi.

Formosa.—The eastern part of Formosa, nominally under Chinese rule, has for the first time been crossed by a European, Mr. G. Taylor. The tribes in this territory differ very much from one another, a fact that Mr. Taylor attributes to their various origins. The Tipun, according to their own declaration, came from islands further north (probably Japan); the Paiwan, who chiefly populate the mountain districts of the interior, are of Malayan origin, and probably the oldest inhabitants; and the Pepoahan came from the Liu-kiu Islands. The latter are the only race who, having no native language, exclusively use the Chinese vernacular. The Diaramok, in the south of the island, are reputed cannibals, and are mostly feared.

Christmas Island, Indian Ocean.—This island, which must not be confused with the other of the same name in the Pacific Ocean, has lately been annexed by Great Britain. No very exact or accurate account of it has yet been published, but, now that it has come within the sphere of British influence, we may expect it to be thoroughly explored and described. Many years ago Captain Richardson of the *Pigot* lay off the shore for a couple of days trying to find an anchorage, but was unsuccessful, the least depth got by the boats being 95 fathoms on hard rock. The coast-line appeared to be entirely steep-to, except at the NW. end, where a small cove, with a beach composed of white stones and coral, afforded a landing-place for boats. The area of the island is small, it being only about six miles long by four wide. It rises to a height of 1100 feet, and is covered with coral to its summit, this superficial covering overlying a core of volcanic rock, the whole formation being apparently the same, but on a much grander scale, as was observed by Dr. Guppy among the Solomon Islands. The cliffs often attain a height of 150 feet, are much honeycombed by the sea, and rise, tier above tier, to the summit. There were at one time extensive deposits of guano upon the island, and these may still exist in the interior. Coco-nut palms are so plentiful as to lead to the hope that some trade in them may be done should colonisation take place. It is not, however, probable that the island can sup-

port a permanent population, as, from the porous nature of the soil, the rainfall is immediately absorbed, and any one remaining on the island would have to put up with the use of distilled water or the milk of the coco-nuts. The vegetation is tropical in character, and is exceedingly dense. Land crabs swarm over the whole island during the day, their place being taken at night by myriads of rats. Boobies are common. Christmas Island lies 500 miles SW. of Java, and is sometimes known as Money Island.

The Colonies and India, of 25th July, referring to this annexation, says :— The island appears to have been taken over for an exactly similar reason as that which prompted the annexation of Christmas Island in the Pacific a few months ago. It is understood that the formal annexation of the island has been considered desirable in view of the projected laying of a cable to connect India with Western Australia.

British North Borneo.—The British North Borneo *Herald* of 1st June publishes the following Reuter's telegram :—"The British Government has signed an agreement assuming tutelage of British North Borneo." We understood some time ago, from private information received by us, that Her Majesty's Government was about to assume the Protectorate over North Borneo, and that it was in contemplation to extend it over Sarawak as soon as Rajah Brooke had arranged the matter with his Council.

Nicobar Archipelago.—Dr. Svoboda contributes to the *Mittheilungen* (Nos. 5 and 6) of the Vienna Geographical Society an account of a short visit paid to these little-known islands by the Austrian corvette *Aurora*, on board of which he was surgeon. These islands, twelve of which are inhabited, lie to the south of the Andaman Islands, in the Sea of Bengal, and comprise an area of 738 square miles. The largest, Great Nicobar (or Sambelong) has alone an area of 632 square miles. The population, according to English sources, numbers about 6000 souls.

The islands were long known to the Arabs in the most remote times, and they were frequently visited by Portuguese vessels : the natives still retain (like the Malays) Portuguese words in their vocabulary. In spite of the notorious malaria, which has kept these islands from being much frequented, an English colony was established at Kaka-na, on Kamorta Island, which has now became a penal settlement for India.

The Nicobars are usually divided into three groups : (1) the northern islands, including Kar Nicobar, Batti Malwe ; (2) the central islands, including Tillangchong, Chowra, Teressa, Bompoka, Kamorta, Trinkut, Nangcowry, Katchall ; and (3) the southern islands, embracing Great and Little Nicobar, together with numerous islets : Meröe, Treis, Pulo Milu, Montchall, Cabra, Condul, Pulo Babi, Boat Rock. These names, which are in common use, are given according to the English spelling.

The flat, northern islands have a denser population, and produce more cocoanuts ; the northern islands are mountainous, and for the most part are covered with impenetrable jungle. Some 45 ships touch annually at Kar Nicobar, from Ceylon, the Coromandel Coast, Burma, and the Straits Settlements, for cocoanuts. In the harbour of Nangcowry there are always a number of vessels. The islanders also trade extensively in the "sea-slug soup" (*Holothuria edulis*) and "birds'-nest soup" of the Chinese ; their only industry is the manufacture of clay pots, which are made chiefly in Chowra, and imported on the other islands.

Malaria, which flourishes in consequence of the rank and exuberant vegetation, is most dangerous during the months of October and November: when dry hot weather supervenes after the south-west monsoon.

The inhabitants of the Nicobar islands Dr. Svoboda divides into two groups: (1) the Shab-Dwa, on the coast, and (2) the Shom-Pen in the interior. The first, although lighter in colour than Malays in general, appear to belong to that race; they resemble, in their features, Siamese and Burmese. The men, with their long hair, are repulsive in appearance, well-formed, but with no muscular development; and the women, especially the married women, are even less attractive. The younger generation is jealously kept from the view of strangers. Marriages, it may be mentioned, are far from fruitful.

The inhabitants of the interior—named *Shompen* by the coast people—were, according to Dr. Svoboda, a mysterious unknown people previous to the visit of the *Aurora* to the islands. *Shom* means a people, and *Pen* is the name of the race. From its isolation the race is purer in the interior than on the coast; Mr. E. Man considers it to be more closely related to the Mongolian than to the Malay.

The dress of the Shom-Pen is simple. Like the coast people, the men wear a T-shaped loin-cloth and the women a short skirt of cotton-cloth or one of native manufacture (*Celtis vestimentaria*). Both peoples wear short pieces of bamboo in their ears, and coloured necklaces sometimes 11 feet in length, made of glass beads or ribbon. The people of the interior are more industrious than those on the coast, and engage in agricultural pursuits. The only weapon of the Shom-Pen is a lance or javelin (*hinyuan*), with a jagged point of very hard wood, which they use with great dexterity.

Dr. Svoboda concludes his article by entering at some length into the details of the visit paid by him to the islands on board the *Aurora*, at the end of 1886, to which we must refer our readers for further information.

Nanusa Islands.—This island group in the East Indian Archipelago has rarely been visited, and their position in the maps is not always correctly given. They lie in about 4° 35′ N. lat. and 127° 5′ E. long. We are indebted for a brief description of the islands to Mr. Ebbinge Wübben in *Petermann's Mitteilungen*, v. 1888. There are seven islands in the group, lying in a crescentic position north and south; their names are Carata, Karaton, Mengampit, Mengnupu, Itata, Onrata, and Marokka, and of these Karaton, Mengampit, and Onrata are alone inhabited. Only at Karaton is there any anchorage (sand, 15-17 fathoms), but at the south and east coasts of this island, as in the case of all the other islands, reefs are found which render navigation dangerous. The island of Mengampit is visible from afar, as in the centre there is a hill 800 feet high; it is thickly wooded, and yields, chiefly, maize, coco-nuts, bananas, and certain earth fruits. Ebony is found in quantity, though of inferior quality. The three *kampongs*, or settlements, are situated in the south and south-west of the island. Karaton is in general flat; on the north side, however, there are hills reaching some 200 feet in height. The inhabitants of the Nanusa islands are all heathen, and number about 1000, distributed as follows: Karaton, 250; Mengampit, 600; Onrata, 250. They are fairly dexterous, and occupy themselves chiefly with fishing and the raising of maize; the abundant timber is used for the construction of praus, in which voyages to other islands are made. Pigeons and sand-pipers fly in great numbers. As for drinking-water, it is sweet and bad, and has an unpleasant odour; it is obtained from springs in the interior. The island of Mengnupu is low and wooded; reefs occur off

the north and south shores. Itata and Onrata islands—called also Karaton by the natives—appear to have been at one time connected. The island Marokka is low, and thickly overgrown.

The *kampong*, or settlement, on Karaton consists of seven large houses built on piles. The twelve to sixteen families inhabiting them live in a state of disgusting uncleanliness : it appears to be a time-honoured custom to permit refuse to lie where it falls. Mr. Wübben describes what he saw on the occasion of one visit, when he was politely invited into one of the huts. The men were all very dirty—some wore a long dress, not unlike a "peignoir"; many wore their hair done up in a chignon, and others had their hair cut short or had a tonsure; none had beards. The women—not so repulsive—had for their costume a sarong of the so-called coffin—a native stuff; on the left arm they wore one or more decorated armlets of mussel shells; the upper portion of the body was mostly unclothed. The people possessed innumerable articles of carved wood (weapons, shields, etc.), which were laid out on a box supported on legs, and were spoken of as sacred things, and which are used in ceremonial observances; but the European visitors were nevertheless permitted to possess themselves of a wooden sword, a shield, and an imperfect imitation of a gun. The language of the inhabitants of the Nanusa islands is said to be related to that spoken in the Southern Philippines, although some understand and speak Malay.

In concluding his brief description, from which the above is taken, Mr. Wübben states that the Menangis Islands delineated on the maps and charts do not exist in reality, and appear to be confused with some of the Nanusa Islands.

AFRICA.

Sierra Leone Boundary.—A more exact definition of the boundary between Sierra Leone and Liberia is given (*Petermann's Mitteilungen*, viii. 1888) in the treaty signed at Monrovia, 11th November 1887. Article 2 of the treaty states :—

"The line defining the north-west boundary of the Republic of Liberia shall start from that part of the sea-coast at which, at low water, the line of the south-east or left bank of the river Mannah touches the sea-coast, and shall continue along the line, which at low water is shown on the south-east or left bank of the river Mannah, until this line or its continuation in a north-east direction cuts the boundary line or its prolongation, which indicates the continental or north-east boundary of the Republic, with such deviations as may be afterwards deemed necessary in order to bring into Liberian territory the town Boporu or other towns which belonged to the Republic before the date of this treaty."

Muata Yamvo: Central Africa.—We have received from the Lisbon Geographical Society a circular giving the results of the recent Portuguese expedition to (Lunda) the State of Muata Yamvo, undertaken in 1884 by Major H. de Calvalho and two subordinate officers, who have now returned to Lisbon. The expedition, which was sent out by the Portuguese Government, was organised at Malengé, in the Portuguese province of Angola, and the circular of the Lisbon Society now supplies us with the geographical positions of several points fixed by the expedition *en route*. They are as follows :—

Places.	Latitude S.	Longitude E.	Altitudes in Mètres.
Malangé,	9° 32′ 10″	16° 15′ 0″	1154
Kafuxi (Ndála Kuisua),	9° 0′ 10″	16° 42′ 1″	832
Mbango (left bank of the Lui),	8° 37′ 48″	17° 6′ 30″	701
Mona Samba (left bank of the Kuango),	8° 27′ 49″	17° 32′ 40″	765
Kasasa (right bank of the Kuilo),	8° 9′ 18″	19° 39′ 20″	1083
Kaungula (right bank of the Lôvua),	7° 26′ 14″	20° 16′ 0″	822
Na Banza (left bank of the Xicápa),	7° 18′ 10″	20° 29′ 27″	706
Xibango (right bank of the Xiumbue),	7° 38′ 22″	21° 17′ 5″	758
Kaungula de Matába,	8° 20′ 4″	21° 31′ 18″	877
Kasai (port),	8° 34′ 12″	21° 56′ 12″	862
Kaungweyi (right bank),	8° 30′ 18″	22° 22′ 20″	1009
Lulúa (right bank),	8° 27′ 26″	22° 30′ 30″	996
Luisa (left bank),	8° 25′ 12″	22° 46′ 44″	1023
Luambáta,	8° 22′ 28″	23° 7′ 36″	1045
Musumba (left bank of the Kalanhi),	8° 21′ 12″	23° 10′ 54″	979

These positions are given with all reserve.

AMERICA.

The Expedition across Greenland.—Mr. Gamel of Copenhagen, at whose cost the expedition under Dr. Nansen has been sent out to endeavour to cross from the East Coast to the West Coast of Greenland, has, according to the *Standard's* correspondent at Copenhagen, received the following telegram :—"*Sandöfjord, Norway, August* 5.—The expedition left the *Jason* on July 17th, at 7 o'clock P.M., three-quarters of a mile off Sermilik Fjord, and was likely to have reached the coast next day. Sermili Fjord lies on the East Coast of Greenland, latitude 65½ degs. north. The coast is inhabited." Sermilik Fjord lies in about 66 degs. north latitude, on the coast of King Christian IX. Land, in the neighbourhood of which are the Anmagsalik natives.

Canadian Industry.—The Budget speech of Sir Charles Tupper, Minister of Finance, to the Dominion Parliament on 27th April 1888, has been published, with an Appendix of 29 diagrams presenting in a graphic form the chief statistics of Canada for the past twenty years. The total exports and imports of the Dominion show a rapid rise during the first two years of protective tariff, but since 1882, the year of greatest exports, there has been a steady diminution. The diagram of chief exports in 1887 shows that grain is rapidly approaching the value of wood and its manufactures, and already exceeds the next item, animals, by nearly 50 per cent. A chart of business failures sets one aspect of the introduction of protective tariffs in a strong light ; during the three years preceding 1879, when protective duties were imposed, the failures averaged 25 million dollars a year ; during the three first years of protection they fell to 7½ million ; the deposits in the chartered banks of Canada rose at a bound from a yearly average of 60 million dollars to one of 95 million, considering the eight years previous to and succeeding the change of fiscal system, and a similar state of matters is seen in the record of the savings' banks. The railway mileage and amount of goods carried has steadily increased during the twenty years, but the foreign sea and lake shipping movement has varied but slightly from 14,000,000 register tons during the last eight years. A very remarkable feature of the diagram showing the nationalities of sea-going shipping is that, since 1881, the British share has been declining, while that of Canada and of the United

States has been increasing; the figures in round numbers for 1881 and 1887 are :—

Total Movement of Non-Coasting Shipping at Canadian Ports. Sea-going Tonnage Arriving and Departing.

	1881.	1887.
British, . .	3,526,000	2,657,000
Canadian,. .	1,865,000	2,314,000
United States,	1,793,000	2,288,000
Other Nations,.	919,000	1,102,000
Total, . .	8,103,000	8,361,000

The production of coal in the Dominion has increased nearly steadily, but with a rapid rise at the institution of protection, from 623,000 short tons [1] in 1868 to 2,388,000 in 1887 ; but the consumption of coal increased from 715,000 tons to 4,111,000 in the same period, showing that the import of coal has risen from 11 per cent. to 42 per cent. of the total consumption.

Brazil.—Two important expeditions left Rio de Janeiro in June for exploration and work in two of the least-known parts of the Brazilian Territory. The first, sent out by the Ministry of War, under the command of Captain Bellarmino Mendonça, is to open a road from the town of Guarapuaba, on the frontier of the settled portion of the province of Parana, to the confluence of the rivers Parana and Iguassu, and to found a military colony at the latter point. A road is also to be opened along the Parana River from the mouth of the Iguassu to the navigable portion of the river above the Sete Quedas Fall, and from this point to Guarapuaba, *viâ* the valley of the Piquiri. The founding of a colony at the mouth of the Iguassu, where the Argentines are already establishing themselves, will, aside from its military importance, prove of great value in peopling the valley of the Upper Parana, which has been deserted since the time of the expulsion of the Jesuits. By means of the Lower Parana the colony will have free water communication with Buenos Ayres and other markets of the Argentine Republic, where two of its natural products, lumber and matte, will find a ready sale. This will give at once to the proposed colony a commercial importance far beyond that of a purely military station, and will doubtless lead to the rapid spread of population along the Upper Parana and its tributaries, with their hundreds of miles of navigable waters. The second expedition, consisting of three military engineers, Captain Lourenço Telles, and Lieutenants Miranda and Villeray, is sent out under the auspices of the Sociedade de Geographia de Rio de Janeiro, the expenses being borne by the Ministry of Agriculture. It is to proceed to Cuiaba in the province of Mato Grosso, pass by land to the head-waters of the Paranapinga, and descend that river and the Sao Manoel or Tres Barras to the Tapajos, returning to Rio de Janeiro *viâ* Para by the Tapajos and Amazonas. This exploration will thus be a valuable complement to that of the Tapajos by Chandless, as the Sao Manoel and Paranapinga are almost absolutely unknown.—*Science*, 27th July 1888.

[1] A short ton = 2000 lbs. ; *i.e.* 28 short tons = 25 British tons.

AUSTRALASIA.

German New Guinea.—The *Nachrichten über Kaiser Wilhelms-Land und den Bismarck-Archipel*, Heft ii., 1888, records the continued diligent survey of the coast between Finschhafen and Cape Croisilles. Much of the land consists of grassy plains, or rises in four or five successive terraces, intersected by rivers, the soil, the product of erosion, usually consisting of the *débris* of volcanic as well as of coralline and older rocks, easily cleared, and suitable for the usual tropical cultivation, and some of the slopes, especially on the north side of Astrolabe Bay, for coffee. Some available harbours have been discovered, lands purchased, and arrangements for settlement made. The people seem friendly, but timid; the chiefs are the heads of families, owing their influence partly to their personal qualities and partly to their possessions.

In one village, Maraga, on the Astrolabe plain, the natives, though undistinguishable from their neighbours, spoke a distinctly Polynesian language. Inland from Butaeng the houses and the cultivation were strikingly superior to those on the coast, and the *Massoi*, the bark of which is in great demand among the Chinese, was found growing in large quantities.

At Finschhafen, on the morning of the 13th March, a sound as of thunder was heard; the sea became violently agitated, and a reef off the harbour was suddenly exposed to a height of five to six feet, the water returning with equal violence in three or four minutes, and continuing in great agitation for half an hour, after which it gradually subsided. A slight fall of fine ashes was also observed. The wave appears to have been caused by a volcanic outburst at Vulcan Island, in Dampier's Straits, off the south-west coast of New Britain, where there is much reason to fear that it has engulfed the greater part of an expedition headed by two German officials who had landed on the coast a few days before. The captain of the *Ottilie*, arriving at the spot two days after, could not at first recognise the place. The reefs were altered, the level country, with its villages, had entirely disappeared, while towards the mountains the land was strewn with pumice and shattered trees. Five of the natives were found injured by having, as they described, been seized and dashed by the water into the trees. There appears to be just a hope that the remainder of the party, under Messrs. von Below and Hunstein, two valued officials, may have gone inland before the catastrophe took place. No trace of volcanic activity was observable on Vulcan Island, but its form was much altered since a recent sketch was taken; the summit is lower, and a hill, or huge rock, lay at its base, supposed to have been a portion of the crater blown off, which, falling into the sea, may, it is thought, have produced the wave.

British New Guinea.—In contrast with the extensive and systematic labours of the Germans, with an effective staff and the aid of a couple of men-of-war, the development of British New Guinea is limited to an expenditure of £15,000 a year, collected yearly in person from the Australian Governments, and not always without difficulty, as we learn from the last report of H.M.'s Special Commissioner. Three administrative centres of action have been established along the coast, and in their neighbourhood all that can be done with the means available is being done. The only two trading ventures on any considerable scale, viz. in sago and in timber, have proved unremunerative; a large amount of felled cedar remains rotting in the scrub, none having as yet been exported. The report contains some interesting memoranda on native habits and feelings by Mr. Hugh Romilly. On the whole, the natives are less

friendly than formerly, not so much owing to deliberate misconduct as to ignorance and misunderstanding on either side of the motives of the other. The native is much given to dreaming, and feels bound to follow any advice or suggestion which comes to him in this way, however it may affect engagements as to trade, work, etc., made with the white man. He believes himself to be surrounded by spirits, all of a more or less malevolent character. The spirits surrounding the white man are stronger than his, consequently he will readily follow the white man on expeditions, etc., which he would not otherwise have undertaken; but if any mischief or accident happens he considers the white man responsible, and the latter must pay damages accordingly. In the same way, if sickness breaks out in a district where a white trader is resident, his life will not be safe, or at all events he must leave the district, unless he pays substantial compensation. In case of a severe epidemic, after all the usual plans for exorcism have failed, they will take to firing at any moving object in hopes of killing the spirits, and on one occasion begged Mr. Lawes, if he passed through the village at night, to put on white clothes so that they might recognise him. This seems to prove at least that the devil is black! As is well known, in case of death at the hands of a foreign tribe, the spirit must always be appeased by the slaughter of a member of that tribe. In the case of white men it is sufficient if heavy damages are paid, and the neglect of this usage, especially in the case of labourers imported into Queensland who were not returned, has been the cause of several outrages. Sorcerers have great influence, though they are apt to be called to account for the failure of their predictions. They are employed to compass the death of an enemy by the usual modes of possessing themselves of portions of the victim's hair, fragments of his food, and the like. A curious custom was observed at Milne Bay. A boy belonging to a foreign tribe was about to be killed and eaten. The women from pity desired to save his life, and their entreaties being of no avail they took off their petticoats and flung them over the boy, and not a man dared to touch him while so protected. When the excitement subsided the men agreed to adopt the boy into the tribe, and the women resumed their garments. It is believed that with further acquaintance with native ideas, and readiness to make allowance for them, a more friendly footing will be established.

British New Guinea.—Mr. J. P. Thomson, our Corresponding Member at Brisbane, writes to us, under date April 8, 1888:—"About the beginning of the present year a party of mining explorers, composed of Mr. Cameron, trigonometrical surveyor, and five other Europeans, proceeded to British New Guinea for the purpose of prospecting for gold and other precious metals. Arriving at Yule Island, in Hall Sound, they selected for the base of their initiatory operations the St. Joseph River, up which they ascended with two native interpreters and trade amounting to the value of £100. On their arrival at the village of Wawabur, the chief, who, through the agency of the interpreters, had been informed of the value and quality of the trade in their possession, demanded them to remain in his town, which, however, they were unwilling to do. Considering it undesirable to be entirely at his mercy, one-half of the party proceeded ahead to the village of Elva, from whence they, after procuring the services of forty carriers, returned to Wawabur. After a long and tedious negotiation, which nearly terminated in a fight, the chief of Wawabur permitted the removal of the trade to Elva, where a powerful chief named Bowra incited the natives to kill the party, and possess themselves of the goods. After the principal chiefs had been presented with some articles of trade, they at length consented to convey

the party to Aina, but the many manifest actions of hostility, treachery, and pilfering by the natives compelled the party to secretly build a raft, put nearly all their goods thereon, float down the rapids, and get out of danger. The raft, which was carried down the river at the rate of 12 miles an hour, struck numerous snags, which caused it to precipitate the whole of its cargo into the river, so that the party lost everything excepting their lives; they were one night out with no clothes on, exposed to heavy rain and the attacks of swarms of mosquitoes. Proceeding down the river, they, after meeting with many obstacles, at length reached the friendly village of Aino, where they obtained food; from thence they rafted down the river for a distance of 4 miles, to a place where they annexed four canoes, the property of their late enemies; and, after travelling all night, they reached Yule Island on the Sunday, where they received succour from the French Missionary of the Order of the Sacred Heart."

The Fjords of New Zealand.—In the *Deutsche Rundschau für Geographie und Statistik* for April 1888, Dr. R. von Lendenfeld has a paper on the fjord inlets of New Zealand, illustrated by a large-scale bathymetrical chart of the south-western coast of South Island. The fjords are, as a rule, shorter than the sea-lochs of the west of Scotland, and although quite similar in configuration, they are generally deeper, resembling more nearly in this respect the fjords of Norway. All the inlets open on a narrow strip of shallow, gently sloping coast, the depth of the water being under 50 fathoms, and the increase seawards to the 100-fathom line being gradual, except at a point opposite Two Thumb Bay, where a deep submarine gully brings 100-fathom soundings within half a mile of land. The author points out that fjords only occur in glaciated regions in the Northern and Southern Temperate Zones, Milford Sound, in lat. 44° 32′, S. being the nearest inlet of this kind to the Equator known on the globe. The purpose of the paper is to controvert Heim's theory of the non-glacial origin of fjord-basins, and very strong arguments are adduced to show that in all cases fjords are either entirely formed, or at least finally modelled by glacial ice. It is satisfactory to notice that the chart accompanying Mr. Murray's paper on Antarctic Exploration in the *Scottish Geographical Magazine* (vol. ii. p. 576) is referred to as an authority for the depths of the Southern Ocean. We abstract a table (altering the metrical measurement to miles and fathoms) of the dimensions of the largest of the New Zealand fjords.

Name.	Latitude of Entrance, S.	Length. Miles.	Breadth at Entrance. Miles.	Depth in Fathoms.		
				Least of Adjacent Sea.	At Entrance.	Maximum in Fjord.
Milford Sound,	44° 32′	10	$1\frac{2}{3}$	33	77	197
Bligh ,,	44 46	10	2	50	60	82
George ,,	44 51	12	$1\frac{1}{3}$	44	44	115
Caswell ,,	44 59	$10\frac{1}{2}$	1	38	33	126
Charles ,,	45 3	$7\frac{1}{2}$	$1\frac{1}{3}$	38	38	115
Nancy ,,	45 7	$9\frac{1}{2}$	1	33	44	131
Thomson ,,	45 10	$26\frac{1}{4}$	$\frac{1}{3}$	88	77	142
Doubtful ,,	45 15	25	$2\frac{2}{3}$	82	66	126
Daggs ,,	45 21	8	$1\frac{2}{3}$	44	27	93
Breaksea ,,	45 35	$19\frac{1}{2}$	$2\frac{1}{2}$	33	98	120
Dusky ,,	45 46	24	$2\frac{1}{2}$	55	88	142
Dark Cloud ,,	46 4	$19\frac{1}{2}$	$1\frac{3}{4}$	22	60	137
Preservation ,,	46 8	24	1	22	11	93

The Kei Islands, East Indies.—Dr. J. A. Portengen, writing from on board the Dutch warship *Samarang*, lying in the roads of Elat, Great Kei Island, to the *Tijdschrift v. h. Nederlandsch Aardrijkskundig Genootschap* (ser. 2, part v.; Verslagen, etc., Nos. 3 and 4), sends some information about the burial caves and rock inscriptions on that group of islands to which it may be desirable to call our readers' attention.

The Kei or Evar Islands lie in 134° E. long., and 6° S. lat., that is between Dutch New Guinea and Tenimber. They consist of Great and Little Kei, with their subsidiary islands. The former, some 50 miles long from north to south, and about 8 wide, is traversed by a range of hills 1200 feet in altitude. These hills go down to the sea precipitously on the north coast, but towards the south they decrease in height and have a gentler slope. The Little Kei group consists of 4 or 5 islands connected by coral reefs; the islands themselves are of coralline formation, and the elevations that occur on them (up to 200 feet) seem to be due to volcanic agency. All the islands are plentifully supplied with fresh-water, and in parts are well wooded.

The inhabitants are a mixed race, sprung from the union of Malays and Papuas. They are in person strong and sturdy, with a light or dark brown skin. They are skilful woodmen, and occupy themselves principally with boat-building. The religion of the bulk of them is Mohammedanism. The inhabitants of Great Kei are noted for their hostility to foreigners, consequently that island is less known than the others. Those who live on the Little Kei group, on the contrary, are peaceable and docile, and yet make bold and hardy sailors. The dwellings are built on piles, and grouped into kraals or family communities; sometimes several families live in one house. The native gardens are planted for the most part with maize, potatoes, and tobacco, with occasionally a little sugar-cane.

The burial of the dead in caves or hollows among the rocks is not now practised to the same extent as it was formerly; in fact this method of interment seems now only to be had recourse to during the prevalence of an epidemic, when deaths are much more numerous than at ordinary times. As a general usage the burial of the dead in these caves has probably been discontinued for fully a century and a half. The natives show great reluctance even to speak about these burial-caves, and a still greater dislike to entering them; and they are always afraid lest strangers who visit them should carry off any relics, and so bring trouble or evil upon their villages. All the caves are found on Little Kei Island; none have as yet been discovered on Great Kei. The corpse before burial is washed and clothed in the best garments the deceased person possessed; it is then enswathed in linen, and placed in the coffin in the midst of soft cushions. At the head of the grave a stake, some six feet high, is erected with a miniature house on the top, intended as a receptacle for rice, sago, and *sirih-pinang*; earthenware jars are placed on the grave. Should a living person dream about one who is dead, he (or she) renews the supply of provisions in the little house at the grave-head of the departed; and the same thing takes place if one of the survivors has need of the advice of the dead. When a death has occurred, the family proceed to kill several fowls and a pig, and on such occasions an enormous quantity of meat is consumed.

On the north coast of Little Kei Island, between Dudumahan and Ohidair, the coral coast rises sheer and steep from the ocean and goes up to a considerable height. In this place a series of parallel lines, traced by the action of the sea, and disposed one above another, on the face of the cliff, show plainly the extent of successive elevations which the coast has undergone. This portion

of the coast is for the native seamen *pamali*; that is, several rude drawings are marked on the stone which he believes to have been made by the evil spirit in person. The real facts of the case are however plain enough: the drawings have been done by human hands. The places chosen by preference are such as are sheltered from the rain by an overhanging ledge of rock. That these primitive designs, representing men, animals, praus (native boats), triangles, human heads, stars, fishes, molluscs, etc., belong to different epochs is to be inferred from the freshness of colour which distinguishes some of them, whilst others are almost obliterated.

GENERAL.

The Continental Centres.—General Dr. Alexis von Tillo publishes in *Petermann's Mitteilungen* (Band 34; iv.), a short paper on the Continental Centres, or that point on each continent which is found to be most remote from the surrounding ocean. These positions he finds to be the following:—

		Lat.	Long.
In Asia:	in the Thian Shan Mountains, between Kuldja and Aravidisi,	43° N.	85° E.
In Africa:	in the Niam-Niam country,	4° N.	27° E.
In N. America:	in the Black Hills, Dakota,	45° N.	102° W.
In S. America:	the Sources of the Paraguay,	14° S.	56° W.
In Australia:	in Alexander Land, north of Lake Amadeus,	23° S.	132° E.

The shortest distances of these centres from the oceans are respectively:—

For Asia,	1616 miles.
„ Africa,	1119 „
„ N. America,	1057 „
„ S. America,	1057 „
„ Australia,	591 „

New Geographical Publication.—Messrs. Asher and Co., of Berlin, have sent us the first two numbers of their new publication, *Mittheilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten.* As a summary of the scientific work and exploration carried out in the German Colonies and Protectorates, it cannot fail to be of service to geographers. Its information is derived from official sources. Heft ii. is furnished with some admirable illustrations, and a large and beautifully executed map of the German colony of Cameroons. To accompany the map, a summary is given of the exploratory work carried out in 1885 and 1886 by the German Government in the Cameroons, of which a notice will be given in our Magazine next month.

MISCELLANEOUS.

Tunis has entered the Postal Union.

M. A. Pavie has been the first European to travel (April and May) from Luang Prabang, by Muong-Sen and Muong-Het, to **Tonkin**.

The new **Direct Railway Route to Constantinople** (*v. S. G. M.* vol. iv. p. 336) *viâ* Isaribrod, Sofia and Vakarel, was formally opened at Sofia on 12th August.

The Würtemberg Society of Commercial Geography has published a comprehensive volume comprising the **Bibliography of Würtemberg and Hohenzollern Geography.**

A summary of Dr. Junker's two journeys in **Central Africa** is given in Nos. 5 and 6 of the *Mittheilungen* of the Vienna Geographical Society, being his address to the Society last March.

A Conference of the representatives of the maritime nations is to be held at Washington, U.S.A., to revise the rules of the road at sea, the signals code, and to consider other important **Maritime Matters.**

For the first time the **Mekong**, from Luang Prabang to its mouth, has been navigated, by M. Gauthier; in spite of its numerous rapids, therefore, it is still hoped that this river may play an important part in the development of Cambodia and Cochin-China.

The *Bulletin* of the American Geographical Society (vol. xx., No. 2) contains a useful paper on the Geographical Evolution of **Labrador**, by Mr. A. S. Packard, illustrated by maps. Mr. Packard also discusses in the same *Bulletin*, "Who first saw the Labrador Coast?"

It is announced (*Parl. Paper*, c. 5352) that, by a treaty concluded 8th October 1887, the Sultanate Pahang has been added to the **Straits Settlements**, so that, with the exception of the small state in the N.-E., the whole of the Malay Peninsula falls under British influence.

In a short report (*Mitt. Deutsch. und Oesterr. Alpenverein*, No. 1, 1888) on his ascent of **Mount Kilima-njaro**, Dr. Hans Meyer corrects his original statement of the altitude reached by him. The highest point reached by him Dr. Meyer now states to be about 5450 mètres (17,880 feet).

Captain C. von François left Bagida on 4th February last, reached Agome Pongbe on the 14th February, and left the next day for Kpandu; the report on the coast of the arrival of a white man at Salaga is thus accounted for. **Dr. Wolf** left Little Popo on 29th March, and went in the direction of Atakpame.

Mr. Joseph Thomson, in a message from Marocco, dated 28th July, announces the safe arrival of himself and Mr. Crichton-Browne on the 24th July at Ambriz, and his success in the chief scientific objects of his mission. Mr. Thomson also states his intention to make a third and longer trip across the Atlas Mountains.

By a treaty concluded on 14th September 1887, the South African Republic (Transvaal) and the "New Republic" have entered into union. The territory of the New Republic will form, under the name of Vrijheid, a new district of the **South African Republic.** This treaty has been ratified by the Parliaments of both Republics.—*Blue-book*, Zulu Land, 1888, c. 5331, p. 37.

NEW BOOKS.

Matthew Fontaine Maury, U.S.N. and C.S.N. By his Daughter, Diana F. M. Corbin. London: Sampson Low and Co. 1888. *Price* 12*s.* 6*d.*

The subject of this biography is most widely known as the author of *The Physical Geography of the Sea.* Amongst oceanographers and meteorologists Maury will always occupy a high place, although many of his scientific results

have been seriously modified by later and more complete investigation ; but it is on his work as originator of the greatest observational system the world has ever seen that his reputation rests. Few have succeeded in getting so many men of all nations and tongues to work together for their own mutual benefit.

Matthew Fontaine Maury, the fourth son of Richard and Diana Maury, was born in Spottsylvania County, near Fredericksburg, Virginia, on January 24th, 1806. His father was descended from the Huguenot families of Fontaine and Maury, who came to Virginia in 1714, and his mother from the English family of Minor, who received grants of land in Virginia from Charles II. Five years after the birth of Matthew, the family removed to a village near Nashville, and here he remained till 1825, when, much to his father's disgust, a midshipman's warrant was obtained for him, and he at once entered upon the active duties of his profession. After a year's cruise in British waters and in the Mediterranean on board the frigate *Brandywine*, and a voyage round the world with the sloop-of-war *Vincennes*, Maury passed his examination, and in 1831 was appointed master of the sloop *Falmouth*, then under orders for the Pacific station, and it was during his first experiences as sailing-master that he conceived the idea of the Wind and Current Charts. From the *Falmouth*, Maury was transferred to the schooner *Dolphin*, on which he acted as first-lieutenant till he returned to the United States with the frigate *Potomac* in 1834. In this year he married his cousin, Ann Hemdon, to whom he had been engaged for several years, and shortly afterwards his first book was published—a work on navigation, which became the text-book of the United States Navy. Maury was next sent on surveying duty to the southern coasts, but, while on leave, met with an accident in which his leg was broken, and which disabled him for active service during a considerable time. The end of this period marks the commencement of his productive labours. In 1839 he began the publication of a series of papers on naval reform, entitled *Scraps from the Lucky Bag*, which attracted great attention. We may note that in these he predicted, amongst other things, the days of big guns and small ships. These papers established Maury's position as an authority on naval matters, and in 1842, on the recommendation of brother officers, he was placed in charge of the Depôt of Charts and Instruments at Washington—an office which he developed into the National Observatory and Hydrographical Department.

The great work which resulted in the Wind and Current Charts, with the accompanying Sailing Directions, was now commenced. Maury received data from the masters of ships of all nationalities, each, in return for his observations being supplied with a copy of the Charts and Directions. The work was but coldly received at first, but soon the Charts came into general use—the time taken on many voyages being much shortened in consequence. At this time also Maury produced his *Physical Geography of the Sea*.

The interest excited by Maury's work bore fruit in an International Meteorological Congress, held in Brussels in 1853. At this Meeting Maury began an agitation, which he continued to push vigorously till the end of his life, for the extension of his methods of meteorological observation on land as well as at sea. To his energy in this direction the United States Signal Service may be said to owe its existence.

The work of the National Observatory went on without interruption till the commencement of the war, when Maury at once resigned his commission and threw in his lot with Virginia. In June 1861, he was appointed Chief of the Sea-coast, Harbour, and River Defences of the South, in which capacity he introduced a system of submarine mining, employing torpedoes exploded by elec-

tricity, and at the same time strongly advocated the fitting out of a Confederate navy. In the summer of 1862, without being consulted, and contrary to his own wishes, he was ordered to go to Europe to purchase torpedo material, and while returning in May 1865, received the news of the collapse of the Confederacy, and surrendered his sword. It being considered unsafe for him to enter the States, Maury offered his services to the Archduke Maximilian, in the attempted regeneration of Mexico. He formed a great scheme for the colonisation of Mexico by the sufferers in the American war, which was approved by Maximilian, who appointed him Imperial Commissioner for Colonisation. Although Maury's best friends tried to dissuade him from entering this service, he carried it on with great vigour and considerable success till the spring of 1866, when he obtained leave of absence and went to England. Shortly after this time, the colonisation scheme had to be abandoned, when difficulties began to press round the unhappy Emperor, who was shot in the following year.

Maury spent the next two years in England, chiefly occupied in instructing officers of various European Governments in the use of his electrical torpedoes. In 1866, he was appointed Professor of Meteorology in the Virginia Military Institute of Lexington, where he settled in the spring of 1869. The duties of his chair were merely nominal, and he resumed the work interrupted by the war—organising a Meteorological Survey of Virginia, and lecturing and writing on scientific subjects. He died on February 1st, 1873, and was buried in Holywood, on a knoll overlooking the James River.

Such are the main facts of a life of great interest and activity. In this book little has been attempted beyond a simple record of these facts, and an indication of their bearing on Maury's private life as shown by his letters and intercourse with his family. We find no serious discussion of his scientific work upon its merits. The sequence of events might have been more clearly stated in some parts — dates being missing here and there, and the general arrangement at times somewhat confused ; and in some matters one could wish to hear more of the other side of the argument. But the chief value of the book lies in the near view it gives us of the man himself—a man of inexhaustible energy, with great powers of origination and organisation, and understanding of men to make them work for him and with him ; a man with a sailor's simplicity and good-heartedness, and kindly nature expressing itself in an effusive way which sounds strange to landsmen's ears ; a man whose life conformed to a rule he lays down in a letter to one of his daughters—"I do not say strive to be content, for in that there is no progression ; but be content to strive."

Le Partage Politique de l'Afrique, d'après les transactions internationales les plus récentes (1885 à 1888). Par Émile Banning. Avec une Carte. Bruxelles : Librairie Européenne, C. Muquardt, Juin 1888. Pp. 181.

The student of African politics will be grateful to M. Banning for his careful collection of treaties and official documents which form the basis of his present book on the political partition of the African continent among the European Powers. At a time when European rivalries are tending to delay the natural development of the more recently occupied territories of Africa,—because in so many cases those who lay claim to them can show no title-deeds or treaties in support of their claims,—it is of the highest importance that "chapter and verse" can be cited in every case which is open to doubt or question : and the official documents regulating the partition of the African territories are so widely scattered that it required a hand such as that of M. Banning, who has

had access to them, to throw these valuable documents into consecutive form. In this work M. Banning has been signally successful. Without speculating on the validity of treaties—especially those contracted with native chiefs—or overburthening his simple narrative by the expression of personal opinions, he shows us clearly how, step by step, East, West, and Central Equatorial Africa have been acquired by the emissaries or diplomats of European Powers. His intention is not to criticise or appraise his wares, but only to display them.

We have carefully read M. Banning's book, and are able to state that, with the exception of the following, his statements are accurate, and his information is well brought up to date.

M. Banning is correct in including Matabeleland within the British sphere of influence in South Africa, but he does not go far enough. All of Khame's territory, between Matabeleland and Bechuanaland, should also have been added. Moreover, British possessions between Bechuanaland and the Zambesi extend more to the westward, so as to include Lake Ngami. Germany, it is true, claims that the Red people (under German protection) extend to the lake, but Great Britain claims that the Bechuanas (under British protection) in reality do so. Probably both are right, and it may result one of these days in a compromise, but the question has not yet come under discussion, and it may be some time yet before it is opened. Again, the boundaries of the Bechuanaland Protectorate are not clearly given. The definition of the Bechuanaland Protectorate, when first proclaimed, was over the territory "situate west of the boundary of the South African Republic, north of the colony of the Cape of Good Hope, east of the 20th meridian of east longitude, and south of the 22d parallel of south latitude." Now, it has been decided that this definition cannot be held to include any territory to the east of the north point of the South African Republic, as it must be to the west of the boundary of the Republic. The north-eastern limit of the Protectorate stops, therefore, at the north point of the South African Republic, *i.e.* at the point where the Makloutse River enters the Limpopo, or about 29° 20′ E. longitude. But as this northern boundary is incorrectly given in all the English maps we have seen, M. Banning cannot be blamed for his inaccuracy; his western boundary, however, is hopelessly wrong.

We shall not criticise the recognition on M. Banning's map (by M. Wauters) of German claims on the East Coast, since he has generously spared Nyassa Land, and acknowledged the priority of claim to this district by the British missionary and commercial agencies on the Lakes.

One very important matter is borne out in the book, and that is the validity of the Portuguese claim to the immense stretch of territory lying between Angola and Benguela, on the West Coast, and Mozambique on the East Coast. M. Banning produces evidence against this claim on the part of the Portuguese, which was not referred to (was probably forgotten) in the recent discussions in London, Edinburgh, and Manchester on this subject. The Portuguese treaties with France (12th May 1886) and Germany (30th December 1886), in regard to the delimitation of their respective territories in this part of Africa, were signed under the strict reservation, both on the part of France and Germany, that this Portuguese claim should not interfere with the rights of a third party (*i.e.* Great Britain); and that the adherence of neither France nor Germany could be given to the definition by Portugal of this trans-continental territory. Both Powers admitted this clause only as "a piece of information." France has no interests there, but Germany has. The clause in the treaty referred to between France and Portugal runs as follows :—

"Art. IV. The Government of the French Republic recognises the right of His Most Faithful Majesty to exercise his sovereign and civilising influence over the territories which separate the Portuguese possessions of Angola and Mozambique, under reserve of the rights previously acquired by other Powers, and, for its part, engages itself to abstain from all occupation" (of the territories referred to).

The corresponding clause (Art. III.) in the treaty between Germany and Portugal, though expressed at greater length, has precisely the same import.

In spite of the urgent requests of the Portuguese Plenipotentiaries, M. Banning states that neither France nor Germany would consent to recognise the above claims preferred by the Portuguese Government; and it is important to bear this in mind, since the question is still open; and the only other interested Power, Great Britain, has not yet given her consent to this arrangement.

As regards the free navigation of the Zambesi, apart from the international law regulating the freedom of navigation of a river flowing through the territories of one or more friendly Powers, it is important to recall the negotiations opened in November 1882 between the Portuguese Cabinet and the English Foreign Office. These negotiations ended in the treaty of 26th February 1884, which was never ratified; but, as a basis for future discussion, it shows that the free navigation of the Zambesi and its affluents, the treatment of Great Britain as the most favoured nation, and the prohibition of any monopolies or exclusive concessions, was clearly recognised by both Powers.

Palestine Illustrated. By Sir Richard Temple. London: W. H. Allen and Co., 1888. *Price* 31*s.* 6*d.*

Sir Richard Temple possesses one of the first requisites for a writer on the Holy Land, namely an enthusiastic interest in his subject. Few travellers will deny that Palestine is not a country for the average tourist. A journey even over the beaten track implies fatigues and exposures unknown in European travel, and is possible without risk of injury only to travellers in good health. The tourist who merely wishes to be interested, pleased, and amused will tell you that Palestine, compared with Italy, does not pay. And, from his point of view, he is right. A visit to Palestine must be preceded by a lifetime of dreams and anticipations. It should be taken only by those who are deeply interested in Scriptural scenes and persons. In short, it is for the muscular Christian. Sir Richard has this qualification in perfection. In the spring of 1885 we met him at Athens. He did not dissent from our opinion that the Acropolis crowned with temples, glowing with the gorgeous colours of an Athenian sunset, was the most beautiful sight in the world. "But," he added, "when I speak of the world, I always put Palestine out of view; for its beauty and interest are beyond comparison."

Animated by this spirit, Sir Richard Temple might reasonably have been expected in this stately volume to add something to our information about Palestine either in the way of new facts or at least by discussing the old, well-worn problems from some fresh points of view. It, however, deals only with the best-known parts of the country. It contains no discoveries, and any opinions stated in it may be derived from easily accessible sources. In this respect it is therefore disappointing.

At the same time it is fair to say that the letterpress professes to be primarily in explanation of the thirty-two coloured illustrations for whose sake the book appears to have been issued. These views, without exception, depict places familiar to persons of ordinary information, and scarcely seem to require

much explanation, nor have they all the merit of strict accuracy. Much of the disappointment of which partially instructed tourists speak arises from the exaggeration in height and size and relative distance which disfigures so many of the pictures of the Holy Land. But the same fault appears in some of Sir Richard Temple's illustrations. Take, for instance, Plate ix., called, "Temple Corner"; the height of the city wall is unduly lessened, while the apparent width and depth of the adjacent valley are much exaggerated. The illustrations are elaborately coloured with a view to represent to the eye the marvellous lights and shadows of a Syrian landscape. We do not wonder that Sir Richard has thought this desirable. In the absence of the grass and foliage which make a western landscape beautiful under the most leaden skies, the scenery of Palestine depends for its beauty on solar and lunar effects. This very spring we had an illustration of this when approaching Tiberias from Nazareth. We got to the top of the hill above Tiberias as the sun was setting. The lake and the opposite hills were bathed in pink and gold; and we wondered how other travellers should have pronounced the scene, every step of it full of sacred interest, but devoid of beauty. Our wonder was shortlived. The sun sank, and nothing remained but the monotonous lines of the distant hills, the dull waters of the lake below, and sad desolation around.

In some of the pictures Sir Richard Temple has been very successful. Plate v., "Jerusalem at Sunset," is very striking, and no previous representation of the Holy Sepulchre buildings has ever given so good an idea of their actual appearance as that contained in Plate iv. "Plain of Esdraelon," Plate xxiv., and "Safed, the City set on an Hill," Plate xxix., are also admirable.

Palestine illustrated may encourage, but it will not supersede, personal inspection of Palestine. The fascinations of the Holy Land are too delicate and subtle for complete delineation either by pen or pencil. Sir Richard Temple's book will, however, be useful to many, specially in its illustrations, as giving a vivid presentation to the eye of some of the most famous scenes in a land no longer "glorious," as Zechariah called it, but still entitled, in the opinion alike of Christian, Jew, and Mohammedan, to the distinctive appellation of "Holy" which it received from Daniel.

Northern Afghanistan; or, Letters from the Afghan Boundary Commission. By Major C. E. Yate, C.S.I., Bombay Staff Corps. With Route Maps. Edinburgh: William Blackwood and Sons, 1888. Pp. 430. *Price* 18*s*.

Major Yate states that these letters form a sequel to his brother Captain Yate's book, entitled *England and Russia face to face in Asia*. His volume of letters is accompanied by two excellent maps—one of parts of Afghanistan, and the other of the north-west frontier of Afghanistan, the latter showing the boundary line between Russia and Afghanistan as finally agreed on, as well as the territory claimed by Russia and Afghanistan respectively. From these maps we now learn authoritatively that the new Russian frontier at Chihal Dukhteran is only fifty-five English miles distant from Herat, as the crow flies. Major Yate thinks that the old high-road from Merv to Herat ran up the Kushk valley, crossing the now ruined bridge at Chihal Dukhteran.

As to the value of the new Herat frontier, Major Yate remarks:—"Russia by the acquisition of Panjdeh has got past the desert frontier, and well down within the radius of Afghan influence; and at first sight it would seem as if there can be little doubt that the Russian foot now advanced will at some future time be either advanced still further or withdrawn altogether, and that a frontier thus arbitrarily defined, as this has been, cannot be expected to be permanent.

But the boundary has this essential advantage, that, having once been defined, it cannot be crossed with impunity, and any future violation of that frontier must necessarily be an act of war."

From these letters, the first of which is dated July 1885, and the last February 1888, we learn the long, trying, and tedious operations of the Afghan Boundary Commission. "Commencing at the time when the question of peace or war between England and Russia hung in the balance, the letters describe the sojourn of the British Commission around Herat during the summer of 1885; the subsequent meeting of the joint British and Russian Commissions in November of that year, and the progress of the demarcation of the frontier up to the time of their separation in September 1886; the return of the British Commission through Kabul to India in October 1886; the negotiations at St. Petersburg during the summer of 1887; the final settlement and demarcation of the frontier during the winter of 1887, and return through Russian Trans-Caspian territory in February 1888; with a general description of the various points of interest connected with the frontier, as well as of the people of the country traversed, and a few notes on the difference between British and Russian military systems in the East."

Being contained in a series of letters written from various places and as events occurred, the narrative proceeds with a freshness and interest which would probably be denied to a formal or scientific treatise. As evidence of how ably and energetically the British Commission worked, the volume will be perused with much pleasure and profit, whilst the hints it offers for the improvement of our Indian army ought to receive public attention.

Die Cordillere von Mérida, nebst Bemerkungen über das Karibische Gebirge, Ergebnisse einer 1884-1885 *ausgeführten Reise*, von Dr. W. Sievers. Mit einer geologischen Karte und 15 Profilen in Farbendruck. Wien and Olmütz: Eduard Hölzel, 1888. Pp. 238.

This is a first-class monograph on a subject of which the author is a master. Dr. Sievers has already accomplished work of the highest interest and value in the same part of the world as that with which the book before us deals, in his papers on the Sierra Nevada de Santa Marta, the mountain system which lies to the west of the Lake (or Gulf) of Maracaibo, in the state of Colombia. In the *Cordillere von Mérida* he describes the systems which rise to the south and south-east of the Santa Marta Mountains. As the title of the book indicates, the author's labours were not confined to the Cordillere von Mérida, which he regards as the north-eastward continuation of the Sierra de Perija or the Cordillere of Eastern Colombia; but he also has a good deal of valuable information to give about the two parallel ranges of northern Venezuela, for which he proposes the name of Caribbean Mountains, and which he regards as a system quite distinct from the north-east extensions of the Andean Cordillera. Into the multitudinous details which enrich his pages we have not space to enter: the book does not admit of condensation, and to give within a small compass anything like a fairly adequate analysis of the topics discussed would be quite impossible; suffice it to say that his treatment is in every respect exhaustive, as well as most painstaking and conscientious. The book as a whole is divided into six sections, dealing with the geology, the structure and surface forms (orography), the effects of the running waters (hydrography), the climate, the vegetation and agriculture, and the population. To this synopsis it will be sufficient to add the following few facts of a general nature:—The

Cordillera of Mérida extend from 7° to 10° 30′ N. lat., and from 72° 40′ to 68° 40′ W. long., measuring 267 miles from end to end; the breadth of the system varies from 50 to 80 miles. Three formations are principally represented in the mountain masses:—(1) the Archaic (consisting of clay, micaceous, and other crystalline schists, gneiss, and granite); (2) the chalk (red and yellow sandstones, and limestone); and (3) the Miocene, though this last is not conclusively made out. This system constitutes the water-parting between the hydrographic regions that drain into the Gulf of Maracaibo and those that feed the upper tributaries of the Amazon.

It is no exaggeration to say that this book is indispensable to all serious students of the orographical structure of the northern parts of South America. The writer is a thoroughly scientific geographer, and his work is invariably well done and trustworthy.

The Last Journals of Bishop Hannington: being Narratives of a Journey through Palestine in 1884, *and a Journey through Masai-Land and U-Soga, in* 1885. Edited by E. C. Dawson, M.A. Oxon. With illustrations from the Bishop's Sketches. Pp. xii. 239. London: Seeley and Co., 1888. *Price* 3*s.* 6*d.*

Readers of *James Hannington* know Mr. Dawson's admirable capabilities as a biographer, and, although he has made but few additions to the existing materials, in editing *The Last Journals*, the work is done well, and illustrates fully the earnest and enthusiastic character of the late Bishop. The journey through Palestine is rich in anecdote, whilst the diary of the subsequent brief African expedition leads one to think that Hannington's impulsive character made him almost foolhardy, and that, but for his venturesome spirit, his career might have been a longer and more useful one. A number of interesting sketches are reproduced.

Anleitung zu wissenschaftlichen Beobachtungen auf Reisen. Herausgegeben von Dr. G. Neumayer, Direktor der deutschen Seewarte. Berlin: Robert Oppenheim, 1888; 2 vols., pp. xiii and 655, and 625. Second edition, with two Plates, numerous Woodcuts, and Index.

It will probably be admitted on all hands that there is a great difference between the work done by British and by German explorers. That of the former is characterised, as a rule, by broad outlines and rapidly formed generalisations, whereas that of the latter is usually of a more detailed and minute description. The reason for this difference may be found in the fact that a German will prepare himself for the work of exploration by painstaking study, or, if circumstances have not permitted this, he will follow with exactitude the rules laid down for his guidance by men well versed in the art of observing in any special branch of science. Although one or two small books giving hints to travellers have been published in this country, we have nothing in our language to approach in either value or extent the work edited by Dr. Neumayer, which now appears in a second and completely revised edition. Every traveller should study this book, for the information it contains will be of priceless value to him. The book will not only show him how to observe, but it will also provide him with sufficient information to enable him to take an intelligent and scientific interest in the various subjects of which it treats. A master hand has edited these volumes, and each article has been written by a man of world-wide reputation. Before

making any critical remarks upon the work, it may be advantageous to give a list of the various papers it contains with the names of the authors appended. By doing so, we shall provide our readers with a key to the importance and scope of the two volumes before us. The first volume contains the following articles :—

On the Determination of Latitude and Longitude. F. Tietjen.
Topographical and Geographical Surveying. W. Jordan.
Geology. Baron F. von Richthofen.
On the Determination of the Elements of Terrestrial Magnetism on Land. H. Wild.
Meteorology. J. Hann.
On the Observation of General Celestial Phenomena, with the unaided Vision or with such Instruments as a Traveller can make use of. F. Weiss.
Nautical Surveying. P. Hoffmann.
Observations on Tides. C. Börgen.
On the Navigation of Unsurveyed Rivers. Dr. J. R. von Lorenz-Liburnau.
Notes on Oceanography. O. Krümmel.
On the Intercourse of Nations. Moritz Lindeman.
Hydrographical and Magnetical Observations at Sea. Dr. G. Neumayer.
Index.

The second volume contains the following articles :—

On Political Geography and Statistics. A. Meitzen.
On Medical Observations. Dr. A. Gärtner.
Agriculture. A. Orth.
Economic Botany. J. Wittmack.
Botanical Geography. O. Drude.
The Geographical Distribution of Sea-weeds. P. Ascherson.
On the Collection and Preservation of Plants. G. Schweinfurth.
On the Broad Outlines of Ethnology. A. Bastian.
On Philology. H. Steinthall.
On Numbers. H. Schubert.
On Anthropological and Prehistorical Investigations. R. Virchow.
Mammalia. R. Hartmann.
Whales. H. Bolau.
Birds. Dr. G. Hartlaub.
On the Collection of Reptiles, Batrachia, and Fishes. A. Günther.
On the Collection of Mollusks. E. von Martens.
On Marine Invertebrata. Professor K. Möbius.
On Anthropoda. A. Gerstäcker.
Practical Hints on the Use of the Microscope and Photographic Apparatus by Travellers. G. Fritsch.
Index.

From the above list it will be seen that a wide field is covered in these volumes, and the bibliography which is appended to most of the papers adds considerably to their value. The plan on which each article has been written is nearly as follows :—A short introduction to the subject is first given, attention is then called to the points to which the traveller should pay special attention ; next, the instruments to be used are explained, or the method to be employed in observing is clearly given ; and lastly, attention is directed to the difficulties which may have to be overcome in attaining the information desired. The various tables and examples have been drawn up with great care, and printer's errors are not very numerous. It would perhaps have been better if a few more woodcuts had been given ; the few which the volumes do contain,

however, are good and well drawn. It would be invidious to single out any of the papers for special praise, as they are all admirably adapted to serve the purpose for which they have been written.

Modern Science in Bible Lands. By Sir J. William Dawson, C.M.G., LL.D., F.R.S., F.G.S., etc. With Maps and Illustrations. London: Hodder and Stoughton, 1888. Pp. xv and 606. *Price* 9*s*.

Anything bearing upon geology, or upon the haunts, habits, and distribution of prehistoric man, coming from the pen of Sir J. William Dawson, ought to be received with a hearty welcome and all due respect. But when he comes forward as an authority of the authorship of the book of Genesis and kindred subjects, it is doubtful if the same value can be attached to his opinions. The volume is altogether most difficult to deal with fairly in the course of a short review. There is so much that is excellent in its pages, so much ingenious argument, so much valuable suggestion, and so much clearly stated fact, that one regrets that the author has chosen to place his work beyond the sphere of criticism as a scientific manual. This is clearly shown by the definition of what is "the rational and successful pursuit of science," as given on page 39. It would appear, although the admission is nowhere made in so many words, that the author's aim has been to provide a way of escape for those who find themselves bound to accept the "evolution theory" for want of a better, and who, were such a way but afforded them, would gladly sever their connection with a belief in the doctrines of *The Descent of Man*. If such were the idea of the author, it cannot be said that he has succeeded, although many may be able to draw considerable comfort from a perusal of the pages of this volume. In lately noticing a smaller work by the same author (*Egypt and Syria*), we had occasion to complain of some vagueness of expression when dealing with the account of the deluge and phenomena connected therewith. Although the same ground is gone over in part of this larger and more exhaustive treatise, the same complaint cannot be again urged against any part of this subject. There is no ambiguity in any of the propositions laid down, and, although we may not always agree with the opinions expressed, or the conclusions arrived at, we can bear testimony to the invariable good-temper and general fairness exhibited towards those who hold opposite views, and who might do well to imitate the example now set them. Sir William Dawson has a good deal to say here about the Pleistocene period, but he avoids any mention of the fact that human life has been supposed to have been upon the globe at that early time. He does not believe this to be possible, and so passes by a very important matter without almost an allusion to it. Human fossils have been discovered in Central America, generally supposed to have belonged to the Pleistocene age, but not the slightest notice is taken of them, and the find of flints, made at Thebes by General Pitt Rivers, is dismissed in a very summary manner. Nor is the reason far to seek. The author fixes the site of the Garden of Eden as on the plain of the Lower Euphrates, a region which must have arisen from below the Pleistocene sea in the form of a great expanse of barren mud, which required the lapse of centuries "before it began to assume the aspect of the Garden of the Lord." But if the whole of this theory be correct, the fossils already alluded to appear to point to a far earlier appearance of man upon the globe—in fact to the presence of a pre-Adamite race, a conclusion which the author cannot accept. We are far from saying that he is wrong in this, but we feel disappointed that he has not alluded to the other side of the question, and, at least, exhibited

its weak points. Nevertheless, the whole argument regarding the site of the Garden is most interesting, deserving attention and consideration. The manner in which the results of modern investigations into the physical features and mineral resources of the basin of the Euphrates are marshalled and employed to throw light upon the rather vague topographical description contained in Genesis ii. 8-14, and to support the author's views, is most ingenious, forming passages of powerful argument. In that part of the work devoted to the volcanic history of Southern Europe, Sir William Dawson is on firmer ground, and does full justice to the subject. The review of the light shed upon many Biblical questions by the ancient buildings of Egypt is certain to find numerous interested readers; the monuments and other remains of that early and wonderful civilisation are described and discussed in a most fascinating manner, and to many will prove the most enjoyable part of the book. The volume is a handsome one, and well got up, although some of the smaller maps are rather coarsely executed. There is a fairly good index appended.

Longmans' School Geography for Australasia. By GEORGE G. CHISHOLM, M.A., B.Sc. London: Longmans, Green, and Co., 1888. Pp. 320. *Price* 3*s.* 6*d.*

This is a new edition of Mr. Chisholm's admirable school-book adapted for use in Australasia by a large reduction of the space devoted to the United Kingdom, and a still larger proportional increase in that given to our Antipodean colonies, the consideration of which comes first. The book is now in better balance as a description of the world, so far as regards the two regions which have changed places, and the new sections on Australia are full and interesting; quite maintaining the high character of the rest of the work. The accuracy of them, moreover, is vouched for by a dozen Australasian preceptors, who have expressed their opinions on the proofs, given advice, and made corrections. This is a great advantage, and the imprimatur will doubtless carry the volume into many colonial schools. It were to be wished, however, that the process of taking to pieces and putting together again had been a little more thorough. All compromises require severe inspection on the part of those who accomplish them, and here, in a book professedly for Australasia, the expression "in our country" repeatedly occurs when the United Kingdom, or, as in the note on magnetic variation (p. 17), the south-east of England is meant. Again, although the statement on the same page that by looking at the Pole star "on a clear night we can always tell the direction in which the North Pole of our earth lies" is true, it is scarcely capable of practical verification by the New Zealander at home. On page 42 the sentence "our winter months (the Australian summer)" also compels the young colonist to travel mentally to the somewhat distant standpoint of his teacher. In fact, it would be well if in books which are scientific, as this really is, the individual point of view and the possessive case were abandoned.

Neue Handelsgeographie: Erdkunde der Warenerzeugung und des Warenumsatzes für landwirtschaftliche, gewerbliche und kaufmannische Schulen. Von Dr. J. J. EGLI. Vierte, verbesserte Auflage. St Gallen: Huber and Co. (E. Fehr), 1888. Pp. 208.

Commercial geography is coming to the front in this country, mainly through the efforts of the Society of Arts and the Schools Commercial Certificates of the English Universities, and in France through the action of special societies, one of which has recently offered a prize for the best French elementary text-book on the

subject. Both countries look naturally to Germany for the best method of teaching this particular branch, or rather aspect, of Geography ; but the new edition of the compact little treatise by our distinguished Corresponding Member, Professor J. J. Egli of Zurich, comes opportunely as a reminder that Switzerland, if not one of the widest spheres for commercial enterprise, is yet one of the most advantageously situated for commercial education.

The first 145 pages of the book form seventeen chapters devoted to a general consideration of the chief countries in the world. The manner of treatment is novel and remarkable, aiming more at a vivid picture than an accurate map of the special states. There are few statistics, but many historical statements regarding the progress of particular industries ; and the leading peculiarities of the countries are impressed by skilfully chosen examples. The account of the opening of the Union Pacific railway in the United States, and of the overland telegraph line in Australia may be cited as two of the best of the many brilliant paragraphs that legitimately illuminate this somewhat matter-of-fact subject ; but the descriptions of Indian jugglery and Parisian street-hawkers, although even more entertaining, strike us as out of place. The description of the United Kingdom occupies ten pages, and on turning them over three paragraphs stand out headed in heavy type, "Scottish Highlands," "English Sabbath-observance," "London City Railways." First come a few lines on the form of the country, a little more than a page on its mineral and agricultural productions, the same space on its manufactures, mentioning the chief districts and their leading towns, half a page on the cessation of work and amusement on Sundays, two on external trade with a digression on the free-trade system, one on railways and canals in general, one and a half on the London underground in particular, and finally two on the chief sea-ports and their trade. The result is to give an admirable impression of the country, or such as might be retained by an intelligent foreigner with good introductions and an inquiring mind after a fortnight's tour ; but in this, as in the other countries described, we miss data sufficiently definite to enable international contrasts as regards industry or commerce to be made. The whole book is in fact qualitative rather than quantitative.

The second part commences with a long and very interesting table of commercial history from "B.C. 3500, beginning of political organisation in Egypt," to the commencement of the North Sea-Baltic Canal in 1887. Then follows a series of paragraphs on shipping, railways, telegraph cables, fiscal systems, the principles of foreign exchange, and other matters of a purely economical or commercial kind ; these are neither numbered nor indexed, and are practically useless for reference unless the reader is very familiar with the book. An index of all the places and products mentioned is, however, a valuable addition.

Where topographical geography is thoroughly taught—as it is on the Continent —this text-book of commercial geography must prove not only fascinating to the reader, but extremely useful. It could not be introduced in this country, however, in its present form ; a fact which says nothing against this book (which we regard with deep admiration), but a great deal against the manner of making the books which have made and largely marred the ordinary British school training in geography.

Elementary Physiography : An Introduction to the Study of Nature. By JOHN THORNTON, M.A. With 10 Maps and 156 Illustrations. London : Longmans, Green, and Co., 1888. Pp. 248. *Price* 2*s.* 6*d.*

This is decidedly the best little book on Physiography recently constructed under the regulations of the Science and Art Department. Mr. Thornton has

gone to many sources for his information, and has faithfully acknowledged the fact while the publishers have contributed quite an historical series of engravings, most of them good, but one or two very bad. Considering that the maps of ocean-depths, currents, rainfall, etc., are printed from line-engraved blocks, they are wonderfully effective, although coarse ; that of "The World, showing Depths," is, however, seriously inaccurate, the worst blunder being that the contour-line of 100 fathoms is represented where that of 1000 fathoms is intended.

A clear conception of both matter and energy is indispensable for a proper understanding of the unity and essential simplicity of the system of the universe, which it is the function of physiography to disclose, and we consider the gravest defect of Mr. Thornton's work is his treatment of energy as a "difficult subject," and his recommendation to omit the chapter dealing with it on a first reading.

While acknowledging the excellence of this book from the point of view of South Kensington Examinations, we must distinctly say that, as an introduction to science, or an explanation of the phenomena of the world, it cannot claim a place within measurable distance of Huxley's *Physiography* or Geikie's *Physical Geography*.

The Clyde from its Source to the Sea. By W. J. Millar, C.E. London: Blackie and Son, 1888. Pp. 324. *Price* 7*s.* 6*d.*

This is a well written and prettily illustrated book on an interesting subject. From his position as Secretary of the Institution of Engineers and Shipbuilders in Scotland, Mr. Millar is well qualified to speak of the mechanical and industrial triumphs of the Clyde ; whilst his knowledge of its topography, geology, meteorology, and history is evinced in chapters devoted to these subjects. Of course, the city of Glasgow deservedly occupies a leading place ; and we notice that, according to Defoe, who visited it in 1727, it was even then "a large, stately, and well-built city," whilst Dr. Samuel Johnson, in 1773, remarked that "the prosperity of its commerce appears in the greatness of many private houses and a general appearance of wealth." Yet Glasgow had then only some 30,000 inhabitants, whereas now, Mr. Millar says, its population within the municipality is estimated at about 544,000.[1] The volume contains an admirable "Plan and Section of River Clyde and Firth," which shows, by means of colours, the elevations of the land throughout Clydesdale and the depths of the Firth of Clyde, and of the sea as far as Ireland, Islay, and Jura.

Heligoland and the Islands of the North Sea. By William George Black. Edinburgh: William Blackwood and Sons, 1888. Pp. 199. *Price* 4*s.*

In this pleasantly written little book, Mr. Black describes the scenery, people, and attractions of Heligoland, and also the islands of North Friesland, such as Sylt, Föhr, Amrum, etc. We should have liked to see a map accompanying such a book as this, for, although Heligoland is a British possession, it is little known in Britain. Over 12,000 visitors, chiefly from Germany, Russia, Austria, and Denmark, annually resort to Heligoland during the bathing season. British visitors are not numerous, owing to a mistaken idea as to the difficulty of getting to Heligoland, which, Mr. Black says, may be reached from London *viâ* Flushing and Hamburg in a day and a half.

[1] See Geographical Note on "Glasgow" in this month's *Magazine*.—Eds.

The Pocket Gazetteer of the World: A Dictionary of General Geography. Edited by J. G. Bartholomew, F.R.S.E., F.R.G.S., etc. London: John Walker and Co. Pp. vi., 630. *Price* 2*s.* 6*d.*

The aim of this publication is to provide a handy reference book where a few of the chief particulars concerning any place of even secondary importance can be obtained. The editor has satisfactorily accomplished this object. The information supplied, although always of the briefest description, is such as the geographical student and general reader are likely to require. The necessary compression of matter has been so well managed that the *Gazetteer*, notwithstanding its clear type, contains more than 35,000 references, and yet is, what it professes to be, a "pocket" volume. We have tested the little book rather severely, and have always found the places we expected to receive notice, and many that we did not look for as coming within the scope of such a compilation. The maps are, in several cases, too small to convey any very accurate ideas regarding the matters they are intended to illustrate, but give general impressions sufficient, perhaps, for ordinary use. In future editions the statistical tables ought to receive careful revision.

Handbook to the Highland Railway, West Coast, Orkney Islands, etc. Season 1888. Seventh edition, revised and enlarged. Inverness, *Northern Chronicle* Office. *Price* 1*s.*

The Highland Railway passes through a district of such romantic scenery and historical importance that a guide-book for the use of those visiting its numerous places of interest must, to be really useful, contain much more information than similar publications for less favoured districts. Considering the large space of country to be dealt with, and the numberless points of interest which have to be noticed, the compiler has done his work in a thoroughly satisfactory manner; mistakes are very few, and, in so far as we can see, nothing requiring remark has been disregarded. The whole volume reflects credit upon those connected with its production; the printing is clear, the paper good, and the illustrations better than those generally found in publications of this class. The map is no worse than the usual guide-book accompaniment; more than this cannot be said in its favour. There is a copious index, making reference to the different places mentioned in the text a work of no difficulty. In future editions we would strongly recommend that the excellent feature of giving the heights above sea-level be extended to all the stations, and not, as at present, confined to a portion of the system. The work can safely be brought under the notice of tourists and others using the Highland Railway, and all who are interested in the country through which it passes cannot fail to obtain useful geographical data from a perusal of its pages.

Administration Report of the Marine Survey of India for 1887-88. By Commander Alfred Carpenter, R.N., D.S.O., F.Z.S., F.R. Met. Soc., in Charge of the Survey. Pp. 26. Bombay: Printed at the Central Government Press.

Commander Carpenter has charge of a most important and useful work, and carries it out in a very thorough manner. The investigations he has lately undertaken, and now reports upon, give results which will be welcomed by the mariner and geographer alike. The appendices contain much valuable matter.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

EXPLORATIONS IN THE CAMEROONS DISTRICT OF WESTERN EQUATORIAL AFRICA.

(Read at Meeting of British Association, Bath, 1888.)

By H. H. Johnston, H. B. M. Vice-Consul, Cameroons.

Some months after my return from the expedition to Mount Kilima-njaro, on which I had been despatched by the Kilima-njaro Committee of the British Association, I was offered the post of Her Majesty's Vice-Consulate of the Cameroons by Lord Salisbury, and I gladly accepted this fresh opportunity of continuing my African studies.

Unfortunately, during my two and a half years' residence in Western Equatorial Africa, my anticipations of abundant leisure for exploration and scientific research were but poorly realised. Owing to circumstances which I need not here detail, I had to accept the commission and undertake the work of the Vice-Consulate of the Oil Rivers in addition to that of the Cameroons, and further, when Consul Hewett returned to England to recruit his health, I was appointed to carry on his work as acting Consul for the Bights of Benin and Biafra. The multifarious duties connected with the administration of the British Protectorate of the Oil Rivers, which at present is under Consular jurisdiction, rendered it necessary for me to greatly curtail my visits to the Cameroons, more especially as those visits were more connected with pleasure—the pleasure of research—than with business, inasmuch as the German rule which is now firmly established in the Cameroons has rendered my Consular duties both light and easy.

Such journeys, therefore, as I have been enabled to make—that is to say, in the district of the Cameroons—were chiefly confined to a short trip up the Cameroons River, six weeks' exploration of the Cameroons Mountain, and three months spent in surveying the district of the Rio

del Rey. Of course, independently of these excursions into the interior, there must also be taken into account a residence on the coast of considerable length, and many minor visits of short duration to places inland.

I will begin by describing my first ascent of the Cameroons Mountain, which took place during the rainy season, in the month of September. I deliberately chose the rainy season for the occasion of my ascent, because none of my predecessors had ascended the Cameroons Mountain during the rains, and had consequently not seen the flora of those regions at its finest development.

I set out from Victoria, a little township on the mainland, opposite Mondole Island, where my residence is placed. Victoria was founded some thirty years ago by the Baptist Mission. I was accompanied by a mixed following of native porters and my own Kru-boys. Our first day's walk was about eight or nine miles up to Bonjongo, a large native settlement and mission station, situated amid majestic forest at an elevation of about 2200 feet above the sea. Here the vegetation was eminently expressive of tropical wealth. Enormous *Bombax*, or cottonwood trees, towered into the sky, crowning their mighty grey columns of trunks with a canopy of light dentilated foliage. The handsome "barwood," with its glossy leaves and small fragrant blossom, the "kundi," or African teak, the "yellow-wood," the ebony, the "sauce-wood"[1] tree, lofty parinariums, showering down with every gust of the breeze their ripe yellow plums, on which the green fruit-pigeons fed so greedily, great umbrageous sycamore figs, whose gouty trunks were wreathed with bunches of red fruit, velvet-foliaged acacias, sterculias, and eriodendrons —these stood prominently forward among the array of noble forest trees surrounding the grassy glades of Bonjongo. Then, also conspicious, were the handsome *Dracæna*, or dragon-trees—an arboreal member of the lily order—which here reached a height of close upon one hundred feet, towering up above the lower trees, and exhibiting most effectively their clusters of long spear-like leaves against the sky. And then the palms —the graceful *Elaïs*, with its crown of delicate fronds poised on the summit of a lofty, slender trunk, and its tidy, compact bunches of orange-coloured nuts neatly tucked away at the juncture of the leaf-stems with the trunk; and, entire contrast, the stately *Raphia*, bearing the largest frond of any existing palm, developing but a short trunk, and yet attaining a considerable height by the sheer ascent of its mighty plume-like fronds, while its huge masses of brown blossom, or its flat clusters of large scaly fruit depending heavily from the head of the palm, presented such a different appearance from the modest fructification of the oil-bearing *Elaïs*. This latter produces the celebrated palm-oil, which is the staple of West African commerce. The natives also drink the sap of the tree as "palm wine." The oil palm (*Elaïs guineënsis*) will not flourish at a much higher elevation than two thousand feet, and, although it may be induced to live at a greater altitude, it fails to produce fruit. The *Raphia* palm, already alluded to, is useful to the natives chiefly for the building

[1] *Erythrophlæum*, from the bark of which a violent emetic is extracted by the "witch-doctors."

materials it provides. The fronds, with a little manipulation, make capital "mats" for roofing a house with strong thatch, and from the midribs are made useful staves and rafters. All round about Bonjongo the flowers of trees and herbs offered brilliant masses of colour. There was the *Lonchocarpus* tree, bearing great sprays of mauve blossoms like the laburnum in shape and kind, and there were many shrubs and creepers of the same leguminous order, with gaudy flowers—yellow, purple, or white. The *Pentas* displayed its beautiful heads of scarlet flowerets, and in all the moist glades rose hedges of *Canna*, or "Indian shot," with flowers of deepest crimson. The numerous species of *Hibiscus* and *Pavonia* contributed their large blossoms of yellow, pink, or white to the wayside herbage, the mauve-pink *Ipomœa* convolvulus trailed over and festooned the bushes, and the ground was dotted with the bright blue flowers of the straggling *Commelina*.

Alas! to most of my hearers this description will seem but a wearisome recital of unfamiliar botanical names, and they will be unable to call up before their imaginations the vivid beauty in colour and form of the tropical vegetation which clothes the lower slopes of the Cameroons Mountains.

As soon as my business at Bonjongo was finished, I ascended another thousand feet to Mapanja, another large native village situated at an altitude of 3,300 feet above the sea. Here I put up with some young Swedish gentlemen, who had recently come out to the Cameroons with the intention of making plantations and trading in indiarubber, which is produced in great quantities in these forests.

The next morning, having engaged a number of Mapanja people as porters, and having previously sent on five men to clear the path through the forest (which from disuse had become much overgrown), I quitted the last outpost of civilisation—the Swedes' dwelling—and started on the long climb to "Mann's Spring," which was to be my camping-place for the night. For a little way after leaving the native village we traversed plantations of bananas and edible arums (*Colocasia*), then we plunged—if you can be said to plunge when you are scrambling up-hill—into the dark forest. The faintly-indicated track ran chiefly along ridges of rock, with a ravine on either side, and often we had to walk for yards along the slippery trunks of fallen trees, these sometimes bridging abysses of vegetation where, in the case of a fall, one might sink far out of sight before reaching firm ground.

The wild-flowers—now I am going to bore you with botany again!—were beautiful almost beyond description, especially the orchids, which were displayed with a variety and profuseness rare to Africa, where this strange and lovely group is but poorly represented as a rule. Some of the orchids—the majority—were terrestrial. There was one species with large heads of mauve purple-centred flowers. It grew in the forest glades with a luxuriance rivalling the wild hyacinths in English woods, and through all the vistas one caught the stream of tender mauve, peach-like colour meandering beneath the soft green verdure of the ferns and lycopodiums. Another orchid grew in masses on the sodden tree-trunks, and its sprays of flowers were white and orange. There were *Angræcums* and

Habenarias, and other orchids, white, white and green, purple, and flesh-colour, new to me and nameless. For the space of our ascent, between four and five thousand feet altitude, we were certainly in Orchid-land. What a scene, and what a subject for the transformation scene of a superior pantomime to be given at Drury Lane a quarter of a century hence, when the general public are educated up to it! Lovely girl postulants could imitate, on a gigantic scale, the sun-birds, the hawk-moths, the bees, hornets, and butterflies visiting the glowing calyxes of these fantastic flowers, which should spring from the ground in tall, sturdy clumps like the great *Lissochilus* orchids by the river banks, and hang from the "wings" and the "flies" after the fashion of the many strange and lovely epiphytic forms which frequent the moist depths of the equatorial forests. When the show of orchids lessened, the tree-ferns appeared on the scene, and added another element of beauty to the exquisite glimpses of forest glades which every turn and twist of the path revealed. In one place we passed for a hundred yards through a natural avenue of tree-ferns, which was named by Captain Burton (when he made his ascent of the mountain) "Fern Gate." Other ferns, though not arboreal, attained a considerable height above the ground owing to the immense size of their fronds, some of them being six feet in length. The trunks of nearly all the trees were thickly clothed with a rich mantle of ferns, often resembling a drapery of green lace. The ground was covered with a dense carpet of delicate lycopodium and orange-tinted moss, from which spongy surface little scarlet fungi gleamed in sheltered places. The prevailing flowers were white, cream-coloured, and pink balsams, blush-tinted, yellow-centred begonias, mauve and white *Labiatæ*, and large white *Commelinæ*; also a strange-looking liliaceous plant, with red, wax-like, tubular blossoms, seemingly allied to the well-known "Golden Rod" (*Kniphofia*) of our gardens. Hereabout the forest scenery had reached the climax of its beauty, and an appropriate *genus loci* presented itself in the handsome "touracos" (*Turacus*), which hopped and flitted among the foliage of the loftiest and most umbrageous trees, feeding in a desultory manner on the ripened fruits. These birds, beautiful alike in shape and in the colour of their plumage, seemed the embodiment of some graceful wood-spirit who had chosen a form in harmony with its surroundings. The particular species found in these forests is coloured thus: body, grass-green; beak, yellow; ridge of head-crest, crimson; wings, purple, with scarlet pinions; and the long tail a deep rich blue. It thus presented an epitome of the prevailing colours of the forest scenery—the tender green of the foliage, the purple-blue shadows of the forest depths, and the yellow and red of the young leaf-shoots and the blossoming trees. However, the touracos were indignant at our intrusion, and paid no count of my out-spoken admiration at their vivid beauty as they flapped their blood-red pinions in lazy flight from tree to tree, but would ever and anon hide beyond some screening tuft of foliage and scream loudly and harshly their accents of warning and dispraise; while the other denizens of the woodland—squirrels, birds, and little antelopes—would take heed to their cries and scurry away from our dangerous vicinity. Desiring to obtain a specimen for identification, I shot one of

these touracos, and this, of course, amply confirmed their previous suspicions. The forest now resounded with the clamour of the indignant birds, which rang in our ears until we had mounted to a higher elevation than they cared to follow.

Above 5000 feet in altitude the temperature was sensibly lower, and we soon found ourselves in heavy mists, which blotted out for a while all the surrounding scenery. The wet mist at first covered us with tiny spicules of water, and then changed into thin driving rain, and at last became a steady downpour, which percolated in heavy drops through the foliage. We were all soon so miserably wet and cold that none cared to stop anywhere for food and rest, but all pressed on to reach our camping-place and arrange our shelter for the night. As we continued to ascend, the forest trees exhibited increasing quantities of white orchilla lichen (known in America as "Spanish moss" and "old man's beard"), hanging in frosty-looking festoons from their trunks and branches; and brambles, nettles, clematis, geraniums, forget-me-nots, and other plants of the temperate zones, made their appearance.

At about 7000 feet altitude we emerged from the forest on to rolling grassy downs, dotted here and there with patches of woodland, and occasionally sprinkled with huge isolated boulders of rock, or furrowed with the half-concealed corrugations of a lava flow. Here forms of life entirely strange to the tropical *fauna* and *flora* of the lower country made their appearance. Stone-chats, wheatears, larks, and buntings flitted, chirped, and sang about the lichen-covered rocks and the stretches of fragrant heather. Clover, dandelions, sowthistles, campanulas, and hemlocks grew amid the wiry grass at the path's side. Against the sky-line rose the bold outlines of the broken-down craters; while the billowy sea of undulating forest land lying on the lower slopes of the mountain side was partially concealed and severed from our surrounding scenery by the long wreaths of white mist, which were really lazy clouds reposing on the tree-tops.

After some seven hours' walking from Mapanja, we left the open grass country, and entered a dense and somewhat majestic forest, which was an outlying tongue of the woods below, that, owing to favourable conditions of soil, had penetrated higher up the mountain-side. Soon after penetrating this woodland we heard the trickle of running water, and, further on, the path was crossed by a tiny stream. Then, in a cleared space under trees of great girth and spreading branches, we saw a small tumbled-down shanty, the last remains of the former encampment of some Swedish travellers, whose names, in common with those of some German and English travellers, were deeply cut into the bark of the biggest trees.

The first evening of our arrival we could do little but put up the tent, and the men had but scanty shelter in the patched-up shanty; but on the morrow I set to work industriously building, and in a few days we had made a little orderly village of five substantial houses, constructed with stout poles and withes, thatched and lined with grass. Such protection as this was really necessary to the men, who, although clothed by me in warm jerseys, and provided with blankets, felt keenly the cold and damp.

Our encampment was situated at an altitude of 7350 feet, and the temperature ranged between 50° and 65° Fahrenheit; moreover, for the first week of our stay, we lived in a perpetual rainfall.

"Man's Spring" is one of the few ascertained sources of water which issue from the sides of the main peak of the Cameroons Mountains. Although known from time immemorial to the native hunters, it was first discovered to Europeans by Mr. Mann, a botanist of repute, in the service of the British Government, who ascended the Cameroons with Captain Burton. Mann's Spring has since been very frequently visited, and is generally the goal and limit of the ordinary ascents of the mountain. The number of travellers who have penetrated further, and ascended to the summit of the High Peak, is very limited as yet.

The forest round this tiny rivulet has a very fantastic though beautiful appearance, with the trees all wreathed and hung with long lace-like drapery of orchilla lichen, the colour of which is a pale greenish-white. When the mist or rain has permeated the forest, the great hanging, swaying curtains and scarves of lichen are all glittering with diamond-drops of water, and then some straying sunbeam comes and lights them up, and makes them sparkle, while it also turns to vivid golden-green the large-leaved foliage of the forest recesses to which these lichen hangings act as *portières*. When there is a further vista of purple-blue, indefinite shadow which the sunlight fails to reach, and the black, twisted boughs and gnarled tree-trunks, heavy with parasitic ferns, frame the scene, then it is most fairy-like, and I commend it as another theme for a thoughtful *Féerie*, or pantomime, to be called "The Dryad's Home."

Mann's Spring is a favourite resort of birds, who always affect the vicinity of water, and here especially they make the air muscial with their twittering songs and mellow love-calls. As man is a rare visitant here, the birds are very bold and fearless, and appeared to welcome our coming for the chance scraps of food thrown in their way. Alas! they soon had to rue their over-confidence. They had put themselves in the power of one whose natural tender-heartedness and love of living things are overborne by his interest in science. Of all the pretty bird-forms which came to drink and sport and bathe by the brooklet, or which hovered about the balsam-blossoms, some of every kind must die to illustrate the ornithology of the Cameroons. And so my native collector and I were soon engaged in skinning black and golden shrikes, metallic-green and crimson-breasted sunbirds, ruddy chats, olive-green warblers, dull grey grosbeaks, and tiny, indefinite, insect-eating birds of blue grey and russet-brown.

In this forest, too, I shot flying squirrels and small vole-like rats. These were the only mammals we saw, except when, very rarely, we got a hurried glimpse of a red-coated, white-striped *Tragelaphus* antelope.

We obtained from the wild bees that hived in hollow trees quantities of the most delicious honey, that, whether from cold or age, had become crystallised and nearly white. Flavoured as it was with the fragrance of the heather, it seemed to me the nicest honey I had ever tasted. Unfortunately I could only eat it with comfort at night-time, because during the day the bees would always find me out, and throng round the

dish which contained the sweet store of which they had been robbed. If I attempted to dispute its possession they would buzz about me in a very threatening manner.

Protected with a mackintosh and knee-boots I sallied out in all the hours of daylight, no matter what the weather might be. Just behind Mann's Spring rose the bulk of a very remarkable crater, looking so exactly like an artificial fortification that Captain Burton christened it "The Earthwork." From its summit we had two very interesting views. One stretched right away over cloudland to the sea, whence, like the ghost of a mountain, or like the suspended Island of Laputa, rose the blue pyramid of Fernando Po. When the white mists suddenly parted, and this distant island was unexpectedly revealed to sight, right up in the sky, seemingly unattached to the earth, it appeared rather as some huge phantasmagoria, some celestial mirage, or land of Fata Morgana, than as an island of actual, terrestrial existence, encompassed by a watery ocean. For often it would rise above an ocean of clouds: a vast, rolling sea of grey billows, with here and there a fleecy crest of white overtopping the furrowed plain.

The other view to be seen from the summit of Earthwork Crater was of a different character and interest to the evanescent scene I have just described. It appealed but little to the artistic sense, while scientifically it was of great interest. One looked up the broad back of the highly volcanic mountain ridge in the direction of the invisible summit, the culminating triple crown of craters. Meandering through the groups of minor eminences was a broad stream of congealed lava, seeming almost to have been suddenly petrified in the middle of its tumultuous flow. It was like the instantaneous photograph of a torrent in motion. Here were small islands of trees and herbage which the flood of molten matter had capriciously left untouched, there the flow had been smooth and unruffled, yonder in the defiles between the hills it must have boiled and churned, and risen in long, swelling billows, whose tortuous crests still traced themselves in wavy lines along the neck of the stony stream. But the wonderful thing about the aspect of this lava-flow was the appearance it bore to having suddenly cooled and hardened as it swept down the back of the mountain. Melted sealing-wax, boiling hot, and suddenly poured over a sheet of rusty iron, would doubtless assume the same aspect in miniature. The edges of the lava-flow rose about four or five feet uniformly above the untouched ground, just as any liquid poured over an unreceptive surface is seen to have retained unabsorbed the elevation of its borders. Throughout the whole descent of the lava stream were scattered jagged fragments of rock, and stones and boulders of various sizes, standing on end at every angle, or lying half-submerged in the congealed floor, suddenly arrested, as it were, whilst being whirled along, by the rapid petrification of the torrent. But that mosses, lichens, a scanty herbage, and a few stunted bushes had begun to speckle the surface of the black lava and grey *scoriæ* (these latter like the froth or foam of the torrent), and that this slight overgrowth had given a more stable aspect to the arrested flow of molten matter, one could have almost awaited its continued movement and renewed descent, and have hoped to

witness from this secure elevation the rolling downwards of the imprisoned boulders, once more whirled round and round by the irresistible avalanche of boiling lava.

In the rare intervals of sunshine, generally in the afternoon, it was very pleasant to lie on the flattened edges of this Earthwork Crater, amid the wiry grass and sweet, fragrant heather, listening to the English songs of the larks, the stonechats, and the buntings, while the busy bees droned and buzzed amongst the flowers.

One side of the crater, as is generally the case, was decayed and broken down, and over this collapse of the rim the ejected lava had evidently flowed out, but at a much earlier date than the mighty lava-flow I have just described. One could see but faint traces of its course, which mainly consisted in an irregular line of rocks in the ravine or valley that cut through one side of the crater slope. These rocks and ridges of lava had been so worn and decayed by the action of wind and rain that their triturated fragments had formed in sheltered crevices the richest soil, and here had been created the loveliest rock-garden you could conceive. Masses of brilliant flowers, delicate tapestries of fern, patchwork carpets of moss and lichen, diversified, but did not wholly conceal, the scattered rocks, which here and there reared jagged pinnacles above the ferns and flowers. In the deep hollows, cracks, and crevices, oozing moisture dripped continually down conduits of moss into unknown depths, and flat symmetrical fern-fronds concealed the black matrix of the rocks with wreaths, flounces, and skirts of green lace. In some places there were cups and hollows in the stone from which a tall fern, or a luxuriant chervil, or a graceful hemlock, sprang in selfish solitude, thriving in the exclusive possession of its own niche. There were thick bushes of *Hypericum* (St. John's-wort), with large yellow, many-stamened flowers, in whose shelter the black-and-gold buntings and their brown, dowdy females perched, and sang, and twittered. There were blazing yellow clusters of sunflower-like *Coreopsis*, and the pale pink crowns of crassulaceous plants like houseleek, and azure-blue blossoms of a creeping monocotyledon like the blue spider-wort, and the ruddy-gold *Helichrysum*, and a pale white blue-lined crocus. The place was alive with birds. Besides the buntings already alluded to, there were pied stonechats of black, brown, and white, chocolate-brown swallows, grey grosbeaks, and speckled larks. One day from the summit of the crater I saw a herd of four large antelopes crossing the lava-flow. Their coats were a light yellow-brown, and the hair was long. The male carried a fine pair of horns. From what I could see through my binocular-glass, they belonged to the genus *Cobus*. As soon as they got our scent, they were off with a rapidity which rendered fruitless any attempt to follow them on foot.

When we had sufficiently explored the vicinity of Mann's Spring, we began to move nearer towards our goal, the culminating peak of the ridge, and for this purpose transferred our camp to a place known as "Hunters' Hut." This was a small shanty of sticks and grass, a night shelter for the native hunters—principally men from Bwea—who crossed the mountain on trading excursions, or for an antelope hunt. The walk from Mann's Spring to Hunters' Hut was of a most interesting character,

and the general aspect of the scenery called to mind the Scottish hills rather than African volcanoes. The fresh, crisp air, the misty sunshine, the grassy downs, the heather-clad hills, were strangely like the Highlands. Yet when one looked downward towards the south, there was Equatorial Africa spread in a living map at one's feet. There was Ambas Bay with its two islands, Ndami and Mondole (on Mondole my white house was clearly visible), and the long peninsula of Monanga; then came the indented coast of Bimbia, and then the mighty estuary of the Cameroons river with its vast mangrove swamps canalised by a silver network of swamps, and its many tributary rivers with their distant courses clearly traceable for miles and miles by lines and flashes of light amid the dull purple-blue of the forested plains.

The coast as far southwards as Batanga was clearly visible, and along the southern horizon rose blue, jagged ranges of mountains that no white man has ever visited. On the main stream of the Cameroons River the white houses of the trading settlements were clearly made out, and one could even see ships lying at anchor thirty or forty miles away. To the eastward the eye rested on the unknown, on a land as yet blank on the maps, but beyond, here and there, the glint of a river, or the indistinct blue sierra of a mountain-chain, little could be distinguished in the vicinity of the hazy horizon.

This view unfolded itself most often in the mellow afternoon, when a flood of yellow light would throw the forested slopes descending to the river into the most vivid relief of golden-green and sombre purple, while the blue smoke from the native villages and plantation-clearings rose straight into the clear atmosphere; but, ordinarily, during morning and noon-tide this beautiful picture was shut out by heavy tiers of massive cumulus clouds, or only remained dimly discernible through drizzling mist.

Along the track from Mann's Spring to Hunter's Hut there were many of those beautiful rock-gardens which I have previously described, and other interesting botanical features made their appearance. Large bushes of yellow *genista* grew on the hill-sides, and among the grass a pretty pink gladiolus (a dwarf species) threw up its stiff blue-green blades and rosy flowers.

The forms of the many craters we passed were very interesting; so also were the strange gulfs and clefts in the earth visible in some places. We also noticed many isolated pinnacles of rock stranded in the valleys between the hills.

"Hunters' Hut," our new encampment, was situated at about 8300 feet in altitude, in a narrow peninsula of forest pushed up the mountain-side. A nearly dry ravine ran through the little settlement, half-choked up with ferns and creepers. Some rain-water, collected in pools amid the stones, supplied us with that necessary element. This great ditch was crossed in several places by natural bridges of fallen trees, some of them beautifully fringed with ferns and violets.

As is my custom everywhere, I set myself to work to make our new settlement comfortable and tidy. I directed the building of four new houses for my men, and four neat little huts soon arose on the cleared

ground. They were built of poles, and thatched with grass, and the doorways were prettily framed with branches of flowering *genista*. Then the next consideration was our food supply. The provisions we had brought with us from Mondole were nearly exhausted, and unless we could induce the mountain people of Bwea to supply us with food, we were threatened with starvation. So I despatched the cook on an embassy with tobacco, cloth, and many tempting gauds of finery. Fortunately, before he got far on the road, he met a troop of Bwea people, men and women, coming of their own accord with supplies of provisions for sale. They had heard from a Swedish gentleman travelling through Bwea that I was likely to be encamped hereabouts, and so they had hurried up to do a little lucrative trade, and see a new kind of white man. They carried neat folding baskets, crammed at present to their fullest extent with bananas, yams, and cobs of Indian corn, and on their heads they poised a strange pent-house of palm-thatch, to protect themselves from the rain, a thing which certainly formed a most effective umbrella, though it took the form of a portable roof, about four feet long. Most of the men carried, in addition to this equipment, a musket and a bag made of antelope-skin, which contained their ammunition, their snuff-box, and their flint, steel, and tinder, besides a multitude of small packets, neatly tied up, and no doubt consisting of necessaries and luxuries for the road.

The women carried the heaviest burdens, and whenever a husband or brother wished to relieve himself of some tiresome article among his paraphernalia, he cast it on to his sister, cousin, wife, or sweetheart, and she meekly added it to her previous load. It is, of course, the custom here, as throughout savage Africa, for the woman to carry the man's luggage. What an admirable arrangement! Man does the fighting, hunting, talking—all the dangerous and difficult work, in fact—and the woman quietly carries out the more humdrum, routine labour of every-day life.

Having well provisioned my settlement, I began to make a start for the ascent of the high peak, the loftiest summit of the chain. The way in which my Krumen and coast carriers suffered from the cold would not permit of my keeping them long at a great elevation and in a low temperature; accordingly I resolved to encamp halfway between "Hunters' Hut" and the summit (a distance of some two hours and a half), and send my men back to the main settlement to sleep, while I remained up the mountain with one attendant. We left "Hunters' Hut" at eight in the morning, and reached my intended camping-place (at an altitude of 10,500 feet) by eleven. During the whole climb (which was very arduous, as we had to cross some fields of lava and *scoriæ*) it rained incessantly, and my unfortunate Krumen turned slaty-blue with misery and cold. Arrived at our destination, I distributed grog with a lavish hand, and the men regained a little warmth, and were able to use their benumbed fingers in erecting my tent. As soon as this was done, I dismissed them, and remained alone with my guide (a Mapanja man named Esuka) and my natural history collector. By noon the sun had dissipated all the clouds and shone out warmly. Then, in a moment, as if some giant's hand had

rent the cloud veil asunder, the mighty peak I was desirous to ascend appeared before me with startling nearness and distinctness.

He was truly an emperor among mountains, clad in robes of red, gold, and purple, like an emperor of ancient days or modern pantomimes. There was no difficulty, with this clear atmosphere, in distinguishing him from the crowd of lesser craters which surrounded his towering bulk like a retinue of courtiers, for not only were they below him in altitude, but while he exhibited such gorgeous colouring, they were all uniformly clothed in unvarying brownish green. In my previous experience of great and celebrated mountains I have seen some renowned for their imposing height, or strange shape, or mighty bulk, and others remarkable for their extent of perpetual snow, or their ice-fields and glaciers; but I never encountered any mountain yet which could vie with the High Peak of the Cameroons in unusual beauty of local colouring.

Beginning with the central and highest peak of the triple crater, its left-hand slope at the top of the ridge had a broad strip of vivid Indian red (formed, in reality, by a layer of brick-red clinkers); then below this came a band of bright yellow (moss); this was succeeded by a large, irregular piece of purplish mauve (fine cinders), quite uniform in tint. On the right-hand side of the middle crater the prevailing colour was greenish grey (grass), dotted here and there with patches of gold and purple. The actual peak of the summit was purplish red, with a very thin gold edge. The lower portions of the middle crater near its base were bright green, streaked with greenish grey where the long grass or the *genista* bushes predominated over the tender herbage. The crust of the crater lying to the right of the loftier central peak was a greenish grey in colour, streaked with red, while the crater rising on the left hand was purplish black in its peaks and upper rim, and a clear slaty-blue round its base, with a few green streaks down its furrowed sides. As before remarked, the minor subsidiary craters lying apart from the main peak were uniformly clad in brownish-green, and therefore offered a complete contrast to the vivid tints of the triple-crowned summit.

I took advantage of the clear sky and bright sunshine to photograph the peak, and then, equipping myself with various instruments, and throwing over my arm a mackintosh, I resolved to make my first ascent of the mountain that same afternoon, for I did not know when I might be favoured with such beautiful weather again, nor even how long this bright sunshine and clear sky might last. I found it unavailing to attempt to persuade either of my two followers to accompany me any nearer to the peak; their teeth chattered with fright at the very suggestion.

"Is it only the cold," I asked, "that you fear? Because it won't be cold on a day like this."

"N—no," they replied in their Negro English, "we no fear for them cold too much. We fear for them ghost-man, Ehwasu. Bakwiri[1] people say Ehwasu fit to kill any black man, 'pose he go for top of mountain (!)"

"Well, then, won't he kill a white man, too?"

[1] Bakwiri is the generic name of all the mountain people dwelling in the Cameroons Mountains.

"P'r'aps," was the laconic reply.

I questioned them further about "Ehwasu" as I stood eating my lunch (for I was anxious to lessen my burdens as far as possible before starting, and preferred carrying my lunch inside me), and I elicited that "Ehwasu" was a gaunt spirit inhabiting the summit of the mountain. He was only *half* a man ("Ehwasu" means "half" in the Bakwiri language). In front he was terrible to look at, for he had a black face with fiery eyes, a hook nose, an enormous mouth, bristling with jagged fangs, white wool, ears down to his shoulders, and a body of gaunt nudity and more than human stature. Behind, however, you only saw a stick supporting a hollow mask, and it would seem that Ehwasu was so justly ashamed of his incomplete nature that, provided you could get behind him and expose the fraud, he vanished and troubled you no more. But the difficulty *was* to complete your tour of inspection, for Ehwasu was not only an artful dodger, but warded off a too near approach by brandishing an enormous club. Moreover, all Ehwasu's utterances took the form of the loudest thunder, which was naturally discomposing to one's nerves—indeed, as a matter of fact, all the local thunder and lightning were respectively the result of Ehwasu's soliloquies and his attempts to light a fire with flint and steel.

Ehwasu, my informants went on to relate, had a standing grievance against white men, inasmuch as they had several times invaded his domains, and yet had never presented him with a gun, although it was the ardent desire of his spiritual nature to possess that weapon, so that he might be on a level with the leading mortal chieftains of the day.

My guide therefore feared for me, knowing my obstinate disposition, and strongly advised me to surrender my rifle, should Ehwasu demand it. I told him, however, that as he would not accompany me I should leave my gun behind, having quite sufficient to carry with my aneroids, my boiling-point thermometer, my compasses, sketch-book, and botanical portfolio. Intending to be absent but a short time, I only carried enough water to boil my thermometer, and also in my sudden hurry left behind my packet of provisions. Various delays had deferred my departure till three o'clock in the afternoon. I could not hope to reach the summit before five, and I must rely on the light of the crescent moon to guide me back to camp.

With the grand peak rising before me, brightly coloured by the afternoon sun, I hurried on towards my goal, traversing a series of grassy undulations with ease, but soon hindered in my progress by having to cross a wide extent of grey *scoriæ*. These winding beds of loose ashes and lava-rocks present a different appearance in the upper parts of the mountain-chain from that which they bear in lower altitudes. They are evidently more recent in origin or superficies the nearer one approaches to their source; that is to say, they are less and less overgrown with vegetation, and do not exhibit so much trace of being worn or decomposed by the action of weather. At the base of the High Peak you would imagine these great layers of ashes had only been scattered there a few months since, and that just sufficient time had elapsed for a grey moss to have grown here and there in patches, where moisture had

accumulated. This moss offers a most peculiar aspect. It is a light grey in colour, and crumbles in the hand like loose soil. At first it only spots the *scoriæ* like an eruption, and gives a mottled appearance to the deep purplish slate-colour of the cinders. Then, a little lower down, it gradually overspreads their irregular surface, until the whole extent of the bed is a uniform light greyish-green. To this sad-coloured overgrowth succeed brilliant golden green and orange mosses of a higher order, then small ferns begin to lurk in the crevices of the harsh *scoriæ*, and they are followed by grasses and an increasing variety of flowering plants, among which may be noted a beautiful blue flower (a kind of *Veronica*), yellow "everlastings" (*Helichrysum*), tall *Senecios*, with mauve or yellow flowers, and most of the rock plants, which I have previously described, in the vicinity of Mann's Spring.

It was both difficult and dangerous walking over these furrowed fields of loose *scoriæ*, especially at this altitude. Lower down the mountain the greater abundance of vegetable growth bound their loose fragments together, and one only suffered from the sharpness of their weather-hardened surface; but here a chance step would send a whole ridge of piled-up cinders crumbling, and in an avalanche of their rasping fragments one was launched on a dangerous descent into some deep and jagged crevice. Although preserving a uniform average level across the whole width of their bed, these rivers of *scoriæ* were deeply furrowed with long ridges and ravines which ran longitudinally with the course of the descent. The edges of the flow of cinders—if I may apply such a word as "flow" to solid, stationary matter, which bore the appearance of an arrested stream—rose about five or six feet above the ground outside its limits, and were often so abrupt and perpendicular as to be unscaleable. Nearly all the soil in the plains and valleys between the craters was covered with the meanderings of these streams of lava and *scoriæ*, but where hillocks or mounds or the paps of the craters arose, the ground was free from *scoriæ*, and densely clothed with short turf, and in some places immense tussocky grasses, resembling roughly the pampas grass in their mode of growth. When I had scrambled over the narrowest portion of the cinder-beds, I found myself walking the sides or round the bases of a large group of craters, and my progress was even more impeded than it had been among the loose *scoriæ*, for I had to wade through a dense mass of closely-growing clumps of this bushy grass which completely concealed the soil, and was at least two feet in depth.

At last I struggled out of the rank herbage on to a clear ridge, on which large shrubs of *genista* and an arboreal heath were growing. Here the ground was covered with the finest black cinders, looking just like coal-dust, but for their bluer colour and larger particles. Here the walking was pleasant and firm. I was now at the actual base of the High Peak, and directed myself towards the central and highest point of the triune crater. Its slope was too steep to climb in a direct line, so that I had to attempt to scale it in a zigzag. The sides of the peak were covered with many diversely-coloured soils and growths, which accounted for the brilliant colouring I have previously alluded to.

There were wide extents of blue-black, finely granulated cinders,

uniform in surface, and often exhibiting a large area free from even a blade of grass; there were other sections of the slope clothed with a thick refulgent carpet of golden moss; then would come tracts thickly clothed with dull-green wiry-grass dotted with bright blue flowers, with here and there a disagreeable ridge of *scoriæ* spotted with grey lichen. In many sheltered niches, or on little shelves jutting out from the steep slopes, grew handsome clumps of silver-leaved "everlasting" flowers and mauve *Senecios*.

I did not find the ascent of the High Peak so trying as some of my predecessors, nor did I suffer in the least from mountain sickness, swimming in the head, deadly faintness, or loss of voice as they appear to have done. In fact I should not call the climbing of the High Peak of the Cameroons (provided you have reached its base, in which lies the real difficulty) a more serious matter than the ascent of Dunkerry Beacon, or some of the North Devon hills. It took me about half an hour to reach the topmost peak of the summit, and here I found myself standing on a narrow ridge (perhaps ten feet in least width) with a yawning descent on each side. All along this ridge there was a complete covering of vegetation to the very apex of the Peak, consisting principally of the pretty blue flower, which I took to be a kind of *Veronica*, "everlastings," and *Senecios*, with several short grasses, and a perfect wealth of golden moss, which formed a soft carpet for the feet. Looking over the edge of the Peak, I saw that there was a bare descent of purple-red clinkers lying for some distance down its outer side. This it was which formed that strange red belt in the colouration of the mountain, noticeable even from a distance of 15 miles. On the very summit of the Peak I noticed two small cairns of stones. Under one, close to the edge of the precipitous slope, was a big champagne bottle half-imbedded in the earth. I could read through the glass the writing on the paper it contained, which turned out to be an announcement in Latin that "Stephanus Rogozinski, Leopoldus Janikowski, Poloni, et Hugonus Zöller, Germanus," had ascended the mountain on some day (date illegible) in December 1884. In the other cairn was a tin box, wherein was placed a paper announcing in Swedish, German, and English, that Messrs. Ljungstedt and Knutson had also made the ascent in February 1886. Not having a tin or bottle handy, I did a rather cuckoo-like trick, by writing my name, nationality, and the date of my ascent on a piece of paper, and putting it away in the Swedes' tin, in company with their own proclamation. Then I replaced the tin under the cairn, and proceeded to business. The air was delightfully still, and the temperature, at 5·45 p.m., 48° Fahrenheit, so I had little difficulty in boiling my thermometer, which, for greater accuracy, I did twice. Water boiled at 188° Fahrenheit, which, properly computed, with the corrections for temperature, gave the height above the sea of this summit of the Cameroons Mountains as 13,508 feet. This estimate was a careful one, and although it makes the altitude of this great volcano less than previous estimations (13,760 feet being the accepted one), I am inclined to believe it is more likely to be exact, as the other calculations of the height were very hurriedly made.

When I had finished my observations for altitude, I proceeded to make a rapid sketch of the strange triple crater which formed the culminating height of the Cameroons Mountains. Roughly speaking, this great mass consisted of one large central crater and two subsidiary ones, with possibly others traceable on the slopes of the northern sides. Round the big central crater ran an irregular ridge or rim of greatly varying breadth and elevation, rising into three principal summits of almost equal height, the central one, facing nearly due south, being considered the highest to all who have yet ascended it. It is just possible that the western peak of the crater may be found, by accurate determination, to exceed in elevation the central summit, but to judge by appearances it is not so. I should have liked on this occasion to have decided the question, but by the time I had finished my work on the central peak it was six o'clock, and the sun was setting; I therefore feared to be benighted on these precipitous heights if I attempted to visit the western summit, consequently I deferred the attempt till another opportunity, intending to return on the morrow.

From the summit of this mountain I had a view which, in magnificence and extent, can hardly be paralleled in the world. The sun, too, was just setting, and his rays bathed all the vast expanse of earth, sea, and sky, in a tender, rosy mist, while the mossy slopes of the mountain side were turned to a refulgent gold. As I commenced my descent over this thick carpet of moss it really seemed as though my feet were plunging through some Oriental fabric of priceless value, woven of gold thread, and I felt some compunction at the long tear made by my headlong course. If I had taken over half an hour to ascend the peak, I think I occupied but little more than five minutes in the descent. It was a most exhilarating sensation, this rapid gliding, sliding, striding over soft moss, and clean, crisp cinder-dust down the steep slope, and the momentum acquired was so great, that I seemed to take flying leaps over any obstacle involuntarily, as though I had no control over my limbs. At length, when the incline grew more gradual, I plunged into a virgin bed of cinder-dust, and on this unstable soil my speed was soon slackened.

By the time I had reached the base of the High Peak the glow of the sunset had faded, and all surrounding nature was steeped in a dull drab obscurity, which, however, when the crescent moon gained in power, changed into the confused light and shade and dim outlines of a badly-taken photograph. I congratulated myself on the clearness of the sky, as, if I had been surrounded by mists, it would have been almost impossible to find my way back into camp. As it was, I hurried over cinder-beds, and tussocky grass, and the crumbling ridges of the lava streams, in a desperate longing to regain the cheerful surroundings of my encampment, picturing to myself—as an incentive to a rapid progress—the splendid supper and the sound sleep with which I would crown this adventurous day.

As a matter of fact, my expectations were doomed to disappointment. In the growing darkness I lost my way among the multitudinous craters, and wandered about the slopes of the mountains for nearly twenty-four hours, and never found my upper camp at all. I was ultimately fortunate

enough to meet some Bwea hunters, who led me back to my permanent camp of Hunters' Hut—or rather carried me back, because from long fasting and excessive fatigue I had become too exhausted to walk. A day's rest, however, set me right, and I soon resumed my explorations of the more western and northern aspects of the mountain, with which, however, I will not detain you now, as I am anxious to pass on to a consideration of the Cameroons River. I might, however, mention before quitting the subject of this grand mountain, that my six weeks' sojourn on its upper slopes had as beneficial an effect on my health as if I had had a holiday in England, and for months afterwards I felt the better and stronger for its bracing air. How and why this magnificent sanatorium for the West Coast of Africa has been so long and persistently ignored and neglected by the different European Governments which rule the Guinea Coast is more than an ordinary person of common sense can understand. I trust the German Government will now endeavour to utilise it as a health resort. It only needs a decent road to be cut from Bonjongo to Mann's Spring through the forest, and a few log huts to be built from the local timber, and then the crews of the many vessels of war on the station, the Government officials, missionaries, and traders could climb up in two days to a European climate and recruit their enervated systems.

From the magnificent heights I have just attempted to describe to the broad area of the mangrove swamps that skirt the flanks of these huge volcanic peaks to the south and east is an abrupt and depressing change, for the eye, after dwelling on fantastic summits draped in the soft white wreaths of diaphanous cloud and revelling in the gorgeous colour of the billowy forest on the swelling uplands where the trees are crowned with their summer blossom, wearies with gazing on the monotonous labyrinth of muddy creeks where the unvarying defile of the mangrove trees exhibits a melancholy study of dull grey-green foliage, white trunks, brown roots, and black mud. This is the aspect of the vast swamps which surround the large delta of the Cameroons River. Like many of the streams which flow into the Gulf of Guinea, it has an estuary apparently out of all proportion to the length of its course, and big enough to serve as the outlet of a first-class river, but in reality this estuary is an old gulf or bay that has served as the common receptacle of many independent streams which in course of time have filled it up and choked it with sand-banks and marshy islands, by means of the accumulated detritus washed down from the crumbling hills and plateaux of the interior.

The name "Cameroons," as you are no doubt aware, is an English corruption of the Portuguese word "Camaroes" (plural of Camarao), meaning "shrimps," or prawns, and it was applied to this estuary by the early Portuguese adventurers on account of the abundance of these little crustaceans, which frequented the brackish water and formed such a favourite item in the native dietary. I only recall this fact to the remembrance of those who may have forgotten it, in order to justify the accepted English orthography of the name applied by Europeans to this important African district. Certain German geographers appear to have

imagined that "Cameroons" was a word of local origin. They therefore docked it of the final "s," and spelt it phonetically as "Kamerun." This, in my opinion, is a mistake. Inasmuch as there is no native name of sufficiently comprehensive character to cover the entire district, it seems more suitable to retain the old Portuguese designation, and spell it as near the original as possible.

About twenty miles from the sea, up the main stream of the Cameroons River, the firm soil begins to intrude on the mangrove mud-flats, and forms low cliffs along the water side on the south bank of the broad river. Here are situated a long succession of populous native towns inhabited by different clans of the well-known Duala tribe, a people of fine physical development, and a character for enterprise, intelligence, and commercial shrewdness, which goes far to explain their long-sustained position of middlemen between the European traders on the coast and the tribes of the interior. Most of the Duala towns are situated on the banks of the Cameroons River, near the apex of the delta. About a century ago the Duala people emigrated from the interior to their present settlements, pushed towards the seaboard by one of those tribal conflicts which in Africa are perpetually forcing wave after wave of the interior population towards the coast. In their turn they ousted the Basa, who had previously occupied the southern shores of the delta, and drove them away from the river. In process of time the Duala split up into different clans under the headship of chiefs supposed to be the descendants of an ancestral ruler, and now there exists considerable divergence of interest and feeling between the different sections of the tribe. The principal chiefs at the present time are "King Bell" (recognised by the German Government as the paramount chief), "King Akwa" and Chief "Lock Preso." Bell Town is perhaps the largest and most important of the native settlements, and it is here that the majority of the merchants are established, and that German authority is concentrated. The Germans have already effected many improvements in the sanitary conditions of the place, and have reared some really handsome and suitably designed public buildings. I should also mention here that the German Government has accurately surveyed and buoyed the once very difficult channel of the Cameroons River, and has simultaneously abolished all pilotage dues, actions which have very greatly benefited our large shipping trade with the Cameroons. I need scarcely detain you with descriptions of other improvements which German rule has conferred on the Cameroons, because it is only to be supposed that a civilised power can hardly take over the administration of a once savage district and fail to show the advantages of an enlightened energetic rule.

As King Bell exercises considerable influence over the main stream of the Cameroons River—namely, the large stream flowing from a north-easterly direction through Budiman and Wuri, it was to him that I applied for a guide when I resolved to make an excursion up this interesting river. King Bell sent his son Beba to accompany me as interpreter, and also furnished an efficient pilot to guide us through the mazy channels of the lower river.

We left Bell Town at eleven o'clock on an unusually sultry morning,

and kept close to the south bank of the river, which above Akwa Town broadens into a lake-like expanse, studded with mangrove islands. It needed some knowledge on the part of the pilot (whose name I ought to mention was Muluti) to steer the boat through the most direct channel, and sometimes we passed through creeks so narrow that the high thickets of *pandanus* nearly joined their branches above our heads, and frequently lashed our faces with their long spiny leaves. This was not, of course, the route that boats of any size or burden would follow, and, like most short cuts, seemed to me less expeditious than the longer and simpler way; for what we gained in directness we more than lost in running aground. However, as branch after branch rejoined the main stream, it recovered its simplicity and amplitude, and at the head of Jibare Island, where the river flows in a single channel, it presented at this season of the year (the middle of June) the appearance of a noble stream, varying from 700 to 1000 yards in breadth.

The monotonous mangroves ceased at the distance of about twenty-four miles from the mouth of the river; but long before they disappeared they had no longer remained the chief components of the swampy forests. *Pandanus*, or "screw pine," began to mingle with the mangrove low down in the delta, and gradually became the dominant feature by the riverside, being skirted, however, along the swampy shore by a fringe of tall *Lissochilus* orchids, which grew to a height of six feet from their base, and reared many a lovely head of large mauve blossoms. As the soil grew firmer and higher the *pandanus* dwindled and gave way, crowded out by lofty forest trees, acacias, albizzias, parinariums, bombaxes, eriodendrons, and sycamore-figs, while *raphia* palms were striking objects, with their mighty plume-like fronds and orange-red midribs, and the oil-palm grew in graceful clusters, often leaning forward over the water for want of space to expand, and the little *calamus* palm scaled the topmost trees of the forest with its hooked fronds, and when it had clambered to their summits, burst into grey-green blossom, and in some places already exhibited its scarlet, ripened fruit.

It was a pretty sight in this portion of the river to see the trading canoes sailing up stream with the sea-breeze, and sticking into the prows of their narrow craft a huge feather-like frond of the *raphia* palm. This was mast and sail all in one, and its graceful filaments would spread out before the wind, while the curling apex nodded helplessly to the rude buffets of the breeze, and the canoe, impelled by this novel substitute for mast and canvas, glided over the water with a gentle swaying motion. The great palm frond, so like a monster feather in appearance, recalled to me the joint discovery of Sir John Kirk and Colonel Yule, how Marco Polo had been shown by the Arabs the dried frond of a *raphia* palm (which would be of a light grey in colour), and had believed that he was gazing on a *bonâ fide* feather of that mysterious and three-quarters mythical bird, the "Rukh" (the "Roc" of our childhood's edition of the *Arabian Nights*); a very natural deception when one considers how this palm frond—the biggest leaf in the world—resembles an ostrich plume in its quill-like midrib and its light curling filaments.

After passing the mouths of the Yabiang River, which descends from

the country of Abo, we stopped for a night at a little village on the outskirts of Wuri. This was under the rule of a young chief who is related by marriage to King Bell of Cameroons; but although a tidy, prosperous-looking village, it was too much under coast influence to be a pleasant resting-place. The inhabitants could not see a white man in their town without continually plaguing him for rum, which spirit they call "bilam," having first of all changed "rum" into "lam" to suit their own pronunciation, and then stuck on a Bantu prefix, thus thoroughly nationalising the name of this ardent spirit. On the whole, however, I am glad to observe that the reign of these coarse and noxious forms of alcohol is no longer undisputed. Sweet wines, such as those called "ginger" and "orange," are rapidly usurping the place of rum and gin in native estimation, and it must be admitted that the change is for the better. And we may hope that in time ginger wine may give place to ginger beer.

Shortly after leaving this place, where we had passed the night without much discomfort, we began to enter upon really lovely scenery. About Bosambo, a turn in the river disclosed a widening lake-like expansion, where the water was of glassy stillness. The banks rose into nearly perpendicular cliffs of one or two hundred feet in height, and these were clothed from top to bottom with the richest forest. The crowns of many of the trees must have risen another hundred feet above the summit of the cliff. What made these wooded heights so beautiful was the fact that they offered a perfect African arboretum, exhibiting in orderly array a great variety of handsome trees and flowering shrubs.

The river in the country of Wuri seemed to have many affluents and branches, few or none of which are marked on any map. Many of them were, I was informed, artificial canals cut by the natives to facilitate communications with the adjacent lowlands, and to divert the superfluous water of the river in flood-time. At one place we actually witnessed a troop of men busy cutting a canal through the bank of red clay which rose some six feet above the stream.

The country of Wuri, which we had now reached, has a prosperous appearance, and seems to be well populated. It is, however, purely a riverine district. The banks of the Cameroons River in this section of its course are one continuous series of villages and plantations. The primeval forest is banished to the interior, where it is just visible in distant lines of gloomy purple-green. The country at the back of Wuri, on both sides of the river, is exceedingly rich in the chief vegetable products of West Africa. The inhabitants, generally known as Basā, bring the palm-oil and sell it to the Wuri people, who again pass it on to the Duala of the lower river, who in their turn sell it to the white men.

On the evening of the second day we reached the last Wuri town on the confines of Budīman—Banyoñ Bosua. Here we met with a most cordial reception from the chief Ngaka, who seemed determined to impress me with the sincerity of his declaration that he longed to see white men come to settle in his town, and that he wished to be regarded as the white man's friend. His house was one of the most comfortable I have ever met with in an African village, and bore witness to the

civilisation of the owner. It was built, like all the houses between Old Calabar and the Congo, on a platform of beaten earth raised nearly three feet above the level of the street. The floor inside was quite hard, like cement, and seemed to be of worked clay, hardened by the action of fire. A native bedstead stood in a recess at each end of the one room, and over both bedsteads gay-coloured mosquito-curtains hung. In the centre of the apartment was placed a huge table, only raised some eighteen inches from the ground, and covered with a white cloth. On this was neatly arranged all my host's collection of pottery and glass ware. This included several big claret-jugs, "Uncle Toby" mugs, and "sitting-hen" butter-dishes. There were also, strange to say, two little jugs of Doulton ware. It seemed a curious thing to encounter these in the interior of West Africa. Along one side of the room ran a massive wooden settle, on which were piled rows of tin boxes containing the proprietor's chief valuables. Near the beds were placed high wooden sideboards, or buffets. All these articles of furniture—table, settle, and buffets—were entirely of native workmanship, and were made from native woods. There was an unusual amount of skill in their construction, and it was remarkable that they were made by joinery, and not merely carved out of solid blocks, as is the usual fashion in Savage Africa. A number of pretty and fancifully-designed stools completed the furniture.

The following day, early in the morning, we left our hospitable Chief of Banyoñ-Bosua with many promises to return, and continued the journey up stream in the direction of Budiman. The river alternately widened and narrowed, and was studded with many islands and sand-banks. At its junction with the Dibomba, an important affluent coming from the north, there was a wide expanse of water which I named 'Hippopotamus Pool' (see following page), from the extraordinary numbers of these huge animals which suddenly made their appearance.

We arrived at the town of Ngale Nyamsi, the chief of Budiman, about noon, and met with an even kinder reception than elsewhere. The same description of tidy house, with home-made furniture and mosquito-curtained bed, was placed at my disposal, and a liberal supply of food was sent, not only to myself but to the Kruboys. After a short rest and a meal I set off with my interpreter and some self-appointed guides to walk along the south bank of the river in the direction of the falls—or, rather, rapids. I left my boat at Ngale Nyamsi's, because it was very slow work pulling up against the strong current. We first walked for two miles through a continuous and pretty town, where fine shady trees alternated with short broad streets running at right angles to the river. Everywhere among the teeming population the same aspect of cheerful industry prevailed, and nowhere did we meet with obtrusive curiosity. Some of the old men rose as we approached, and shook hands with formal greeting, and then returned to their avocations.

When the town had at last come to an end, we went for some distance further, through tidy plantations of vegetables which had very much the look of market-gardens in England. Along the straight path we met a young girl coming from the river, bearing a pitcher of water on her head, and driving a small flock of hairy sheep before her. The aspect

of this peaceful procession and the surrounding landscape, with its abundant crops of maize, edible arums, sweet potatoes, and beans, with here and there the glistening green of the banana-fronds and the swaying plums of the oil-palm, suggested at once a picture entiled 'Peace and Plenty,' which is a scene familiar enough amid these pleasant lands of Wuri and Budiman.

Pursuing our road, we at length entered a fine stretch of forest, where, we were told, a colony of chimpanzees had their abode. The path wound tortuously to a height of about five hundred feet above the river, and then through a break that occurred in the dense foliage we obtained a splendid view, stretching from west to east, embracing the course of the river, and exhibiting a panorama of unknown lands. The afternoon was singularly clear, and I obtained a fine view of a grand chain of peaked mountain lying due north of the river. Lines of white cumulus cloud separated their bases from the horizon, which gave them an added look of height. Placing their elevation above the horizon in conjunction with their alleged distance (three days' journey, according to my native informants) of fifty or sixty miles, I should roughly estimate the height of the two largest peaks in this new chain at between ten and twelve thousand feet; but it is quite possible they may prove higher. My drawing of this unknown range was taken from the marshy plain a little lower down the river.

Plunging again into the cool depths of the forest, we walked through the grey columns and architraves of the mighty trees, under a lofty roof of dim, green foliage. The fruit pigeons fluttered high above us, clustering round the ripe fruit of the sycamore-figs and the sickly-sweet dates of the calamus palms. The grey parrots showed every now and then a bit of scarlet tail as they scrambled round the boles of the tree-trunks, pursuing one another, half in spite and half in play, while every now and then they remembered their nestlings, and dived suddenly into dark holes in the wood. Monkeys, big, middle-sized, and little, swung and dropped from branch to branch, constantly stopping to peer at us through a maze of twigs and leaves, and swearing at us intermittently in guttural tones. Suddenly, in a forest clearing, we came upon the very prettily situated village of Msagha. This lay on a platform of red clay, about 300 feet above the river valley. It embraced the most beautiful views of the surrounding country, and more chains of dim and far mountain opened out to the eastward. The people here had never seen a white man before, at least so they all asseverated, except two slaves from the Ndobo country, in the far interior who somewhat proudly asserted that they had done so in former years before they were sold into slavery, but they added that the white men were bad, and they refused to come near me. Afterwards it appeared that their country had been visited by Mohammedan slave-raiders, who were sufficiently light in colour to be considered white men.

After a long—and to me very interesting—conversation about local geography and natural history, carried on through the interpreter, I rose and walked to the edge of the platform overhanging the river. Hence I could see the hills of Ndokoko, where the stream, passing through its last mountain barrier, descends in a succession of rapids,

which form the usual obstacle between the navigation of its upper and lower course. Whilst looking out over the water three or four black specks rose to its surface. They were hippopotami. Taking out my sketch-book, I signified to those around me that I would make a drawing of the beast that was a mere distant blur on the shining surface of the water. As the protruding eyes, the little pointed ears, the heavy jowl, the great trailing belly, short legs, and four-toed feet grew under my pencil, the admiring clamour of the bystanders gradually sank into awed silence, and when the complete sketch—a tolerably faithful drawing of the hippopotamus evolved from my inner consciousness—was placed before them, all looked scared, and some walked away. "No, this was going *too* far," was the general opinion. "This was no longer funny, it was wrong." One old man, a sort of prophet in Israel, came forward, and roundly accused me of being a sorcerer. He moaned and lamented, and foretold that sad days were in store for their village since a white man had come there and "put things on book." However, the younger section of the populace—scoffers, the progressive party—had recovered from their first shock of surprise, and now began to take my part. It was all right, they maintained, and only white man's fashion—*they* were not afraid. The old man knew nothing about white men; he was an old fool, and what he said about harm coming to the village was nothing but "mbamba"—rank foolishness. The prophet then denounced everybody all round, and pursued several gibing youths with a stick. In the middle of this clamour I stole off to a little smithy hard by, where I had caught a glimpse of a curious-looking forge. Of this I made the drawing, and this further example of my powers of delineation caused increased excitement, but, being recognised as a faithful representation of the original, increased my popularity, and when I set out to return to Ngale Nyamsi's town, I was accompanied by nearly half the population of Msagha.

The next morning I left Ngale Nyamsi's town in a perfect gush of friendliness. My little parting-gift was actually received with hearty thanks—a very rare thing in Africa—and, on his part, the chief outdid me in generosity. He put a fat goat, six fowls, bananas, yams, and fresh eggs into the boat, and waded out into the red mud to give a last shake-hands, and impress on me that I must come again soon to his country. Then, withmany a "nod and beck and wreathed smile," we bade good-bye to him and his people, and paddled down the river on our return journey.

The country about Wuri and Budīman struck me as being a particularly *pleasant* land. Apart from the good-humour and contentment which characterised its inhabitants, there is a cheerfulness in the wide landscapes that should exercise a beneficial effect on the temperament of settlers and colonists. Great breezy prairies stretch across the river-basin, marked in some places by the intense verdure of plantations, but mostly an unvarying yellow-green where the rank grass has not been cut. Here and there, a long winding ribbon of purple-green forest indicates the hidden course of a stream. The sameness of the level plains is broken along the horizon by the pale-blue forms of lofty mountains, which lend

an element of grandeur and mystery to the comfortable landscapes of neat pastures of beans and colocasia arums, waving fields of maize and glistening groves of plantains in the immediate foreground.

The people dwelling on the banks of the Cameroons River and its affluents all, as far as I can ascertain, speak languages belonging to the Bantu family. Most of these tribes seem to be considerably removed in culture from mere savages, and show in the furniture and decoration of their homes proofs of the strong artistic feeling that is latent in so many Negro races, and which, let us hope, will some day be drawn out and developed by a wise, fostering civilisation. Judging from what I hear of the kings and peoples dwelling on the upper course of the Cameroons River, I should say they were slightly tinged with the civilisation of the Mohammedan Sudan. The Budĭman traders are certainly in touch with the Moslem merchants of the Binué River, for, from all accounts, they seem to meet them at the slave and ivory markets of the interior. Unfortunately, the Fula slave-raiders are yearly extending their ravages over the tribes which lie between the Upper Binué and the Cameroons River, and are devastating districts once prosperous, well cultivated, and densely peopled. Sooner or later, they will come into contact and conflict—nay, in a measure they have already done so—witness Lieut. Tappenbeck's repulse—with the Germans, and then let us hope they will receive the sound punishment they so richly deserve.

I have ascended for varying distances some of the northern tributaries of the Cameroons River, but although these journeys were of great interest to myself, they would seem too much like a repetition of the scenes I have already described if I ventured to detail them to you.

A district I have explored at some length is the Rio del Rey. This is really a huge "unnecessary" estuary which receives a number of streams from the northern versant of the Cameroons Mountains, and the various ranges which form a north-westerly continuation of that mass of elevated volcanic peaks. Three rivers of some volume and navigability are the principal feeders of this large estuary. They are the Mbomanjinga, the Ndiani, and the Akpayafe. Besides which, there are a number of tidal creeks communicating with the Akwa and Old Calabar rivers. The greater part of the district, drained by the component streams of the Rio del Rey, is almost uninhabited, hilly, even mountainous in parts, and covered with the densest forests. This country is chiefly interesting as being the borderland of the Bantu. Here meet the Bantu races and languages from the east and south, and the Niger tongues, and peoples from the north. The Bantu family is represented by the Ba-rombi and Ba-kundu tribes speaking most interesting languages which are thoroughly "Bantu" in type; and the Nigerian groups appears in the Efik, the very pushing energetic inhabitants of Old Calabar. The Efik language I have found to be related to the Ibo tongues of the Lower Niger, and though at first sight of the vocabularies the resemblance is not strongly marked, it is strengthened by the connecting links of the intermediate dialects. Besides the Efik and the Bantu peoples, who approach each other from either side of the Rio del Rey, there are the fragments—timidly lurking in the forest, and perpetually in dread of

slave-raids—of some very interesting peoples and languages, which are neither Bantu nor Efik, but which I have recently found to be related to tribes on the Upper Cross River. Altogether, the district from the Cross River to the Cameroons is, linguistically, one of the highest interest, especially as regards the relations of the Bantu languages to the other linguistic groups of Western Africa. I have collected vocabularies of nearly forty languages and dialects, and have made grammatical studies of the more representative tongues, and as these results will probably be published, I will not weary you with any further allusion to the subject.

With regard to natural history I have sent home several collections from the Cameroons Mountains and the river regions in the vicinity, some of which have not yet been reported on. Among those that have been examined by the Cameroons Committee of the British Association, one mammal, a species of shrew-mouse—almost the smallest mammal known —has been discovered which is new to science, and also four new species of birds, and several new batrachia, land-shells, and butterflies; and I believe there are some plants in my recent collections likely to prove new and undescribed.

In conclusion, I must tender my sincere thanks to the British Association which two years ago awarded me a grant of money that materially aided me in exploring not only the Cameroons, but other and adjacent regions, which I have been unable to refer to in the present paper. I regret that my sense of gratitude should have compelled me to inflict on your patience this very lengthy discourse, but I wished to show that I had endeavoured to turn the resources you granted me to some account.

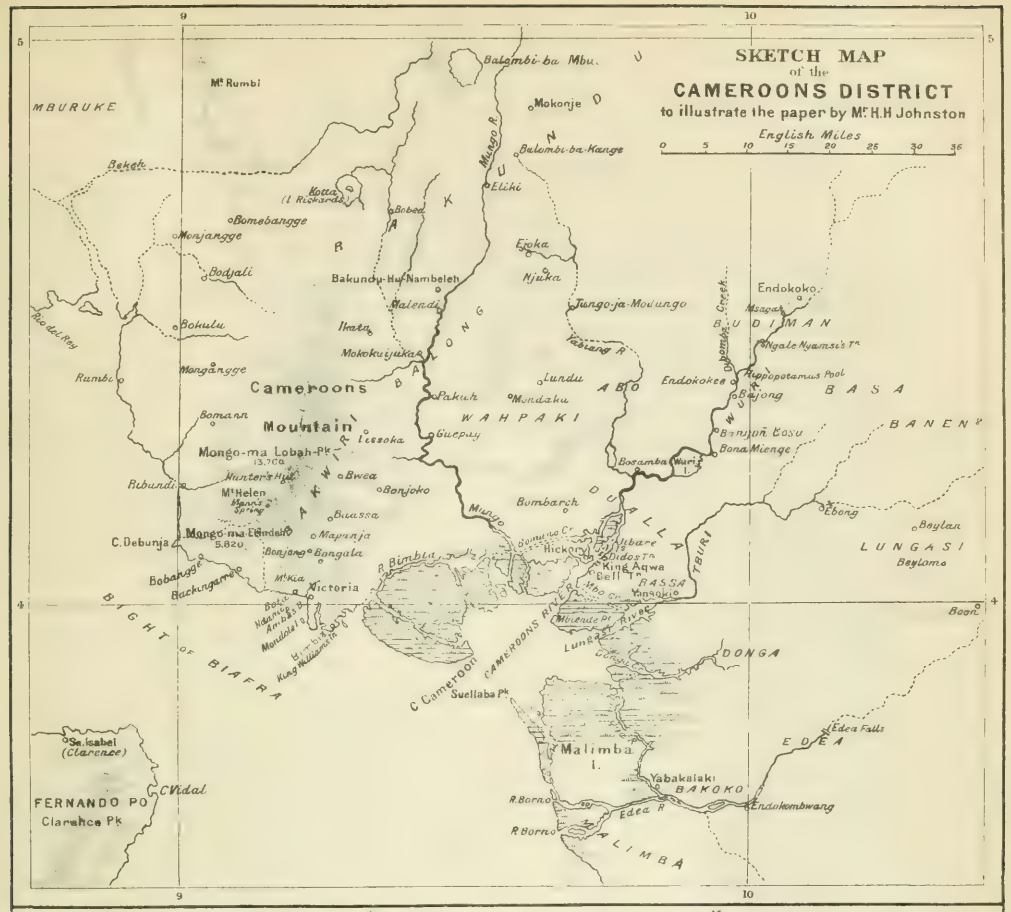
"LITTLE RUSSIA."

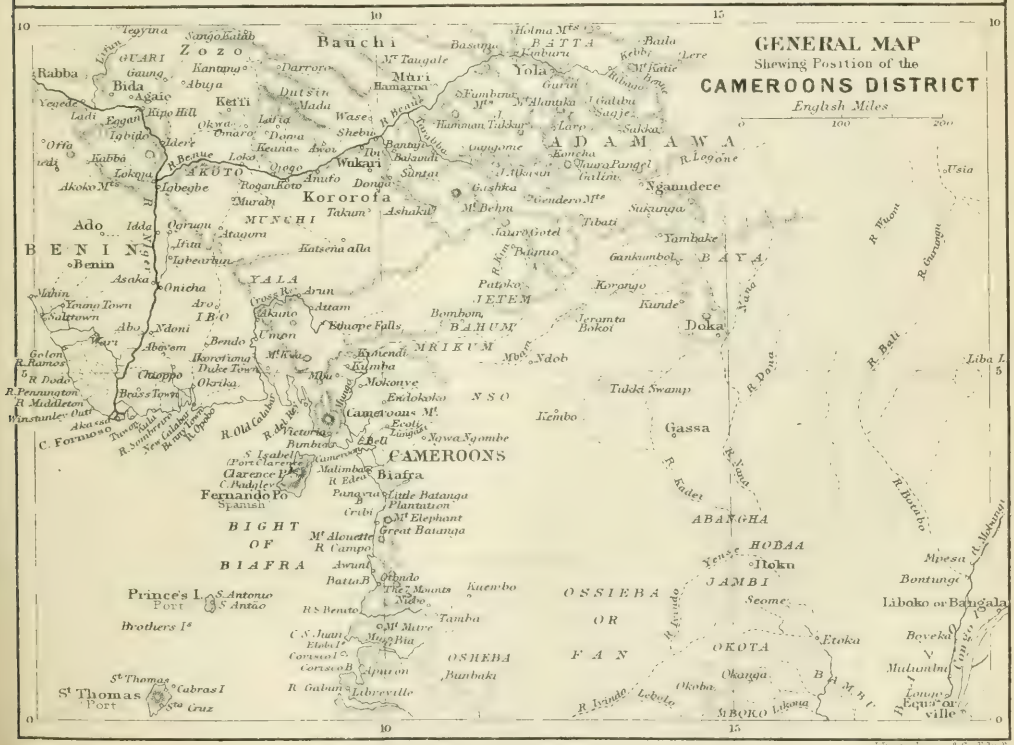
(*Read at Meeting of British Association, Bath,* 1888.)

By E. Delmar Morgan, F.R.G.S.

It is difficult, if not impossible, to say what is meant by Little Russia, which of the provinces of Russia should be included under that title, where Malorossia begins and where it ends. Even among Russians themselves there is a difference of opinion. When I was preparing in Mosco to visit that country, I was told by one of my acquaintance that its centre was Kharkof, and by another that Poltava was the heart of the Little Russian nationality. But at Kharkof, and again at Poltava, I was referred to Kief, and at Kief to Lvof or Lemberg in Galicia, if I wished to acquaint myself with what is known as the Little Russian movement. Any desirous of studying the country and the people thoroughly, and obtaining an insight into the hopes and aspirations of the Little Russians, should visit all these towns, should make some stay in the country, and read attentively the literature on the subject contained in several hundredweight of books.

My claim to be regarded as what is termed an authority on Little


SKETCH MAP
of the
CAMEROONS DISTRICT
to illustrate the paper by Mr H.H Johnston
English Miles
0 5 10 15 20 25 30 35
Mt Rumbi
MBURUKE
Mokonje
Balambi-ba Kange
Balambi-ba Mbu
Mungo R
Bakoko
Kotta (A Richards)
Bobod
Bomebangge
Monjangge
Etiki
Ejoka
Njuka
Bodjali
Bakundu-Hut
Nambeleh
Malendi
Tungo-ja-Modungo
Endokoko
Mpage
Bokulu
Ihatta
Mokokuejuka
Yabiang R
Dikome Creek
Mungale Nyamsie's Tn
Mongangge
Rumbi
Cameroons
Mountain
Pakuh
Lundu
Mondaku
Endokokea
Hippopotamus Pool
Bajong
BASA
Bomann
Lessoka
Guepuy
WAHPAKI
Banjoh Bosu
BANENE
Mongo-ma Loba-Pk
13,760
Bona Mienge
Ribundi
Hunter's Hut
Bwea
Bonjoko
Bona Muri
Mt Helen
Mungo Spring
Bombarch
Ebong
Baylan
Mongo-ma Lundo
5,820
Buassa
Mapanja
C. Debunja
Bonjongo
Bangala
Hicken
Oldes Tn
King Aqwa
Bell Tn
BASSA
LUNGASI
Beylomo
Bobanggo
Buckingham
Victoria
Mt Kia
Yansoki
Bight of Biafra
Boa Island
Mondoli Is
King Williams Tn
Cameroons R
Mbiende R
Lunka
Boom
DONGA
C Cameroon
Suellaba Pk
Edea Falls
EDEA
St Isabel (Clarence)
Malimba I.
Yabakalaki
BAKOKO
C Vidal
FERNANDO PO
Clarence Pk
R Borao
Edea R
Endukombwang
R Borno
ALIMBA


GENERAL MAP
Shewing Position of the
CAMEROONS DISTRICT
English Miles
0 100 200
Bauchi
Holma Mts
BATTA
Basamo
Baila
Lore
Zozo
Mt Taugale
Mari
Yola
Rabba
Gaung
Kantana
Darroro
Kebbi
Mt Katie
Bida
Abuja
Hamarua
Gurin
Nupe
Asaic
Kotti
Dutsin
Fumbina
Mts
Mt Alantika
Galubu
Ladi
Kipo Hill
Wase
Sugje
Egan
Okwa
Lafia
Shebu
Tiv
Bantaje
Jaggomie
Kuncha
Sukka
Tobida
Omaro
Doma
Akoko Mts
Lokoja
Logone
Ibi
Bakundi
Yola
Pangel
Ngamndere
Abuja
Loko
Wukari
Santai
Gashka
Mt Behna
Kororofa
Ado
Idda
Ogugu
Takum
Ashaka
Mt Elephant
Sukunga
Tibati
Benin
Ataiyon
Jauro Gotel
Yambake
Katsena alla
Palmio
Gankumbol
BAYA
Onicha
Korango
Asaka
Aro
Attam
Bombom
Kunde
Doka
Abo
Ndoni
Umon
Bohuye Falls
Jeramta
Bokoi
Abo
Bende
Mbaku
Kyendi
Kyimba
Mbum
Ndob
Liba L
Golon
Chappo
Okrika
Mokonye
Tukki Swamp
Bonny
Endokoko
NSO
Kembo
Gassa
Victoria
Rumbido
Ngwa Ngombe
CAMEROONS
Clarence
Fernando Po
Spanish
Biafra
Malimbe
Panganda
Little Batanga
Plantation
Cribi
Great Batanga
ABANGHA
BIGHT
OF
BIAFRA
Mt Elephant
Mt Alouette
R Campo
HOBAA
Awuna
Batta
Mbondo
Mt Mounts
Kuembo
Hoko
JAMBI
OSSIEBA
Prince's I.
Port
S Antonio
S Antão
Nido
Seome
Laboko or Bangala
Brothers Is
Tamba
OR
Etoka
Bevekol
FAN
OKOTA
Mubumbia
Okanga
Okoba
Lebole
Equator ville
St Thomas
Port
Cabras I
Sta Cruz
OSHEBA
Bumbaki
Libreville
MBOKO
Idoma
R Lyendo
R Ogowe
R Mbei
R Ngoa
R Kadei
R Bocko
R Mokoue
R Wum
R Garoua
R Benue
R Donga
R Middleton
R Pennington
R Ramos
Winnumlee Chief
C. Formoso
Bimbia
New Calabar
Bonny
Old Calabar
Duke Town
Bell Town
Akassa
Brass Town
Nun
Forcados
Ramos
Bight of Biafra

Russia is founded on a stay of only a few weeks this summer in Kharkof, Poltava and Kief, and a short excursion in each of the governments or provinces of the same names. Under these circumstances I would not have ventured to lecture on the subject at all before this learned Association, were it not that in this case a little knowledge obtained from the best authorities may be useful in directing attention to a country and a people likely ere long to become of great political importance, and, independently of politics, interesting to the geographer and ethnologist.

Kharkof is a rising commercial city, the centre of the wool trade, in the midst of a corn-growing country, on the high road between North and South Russia, between East and West, a Russian Chicago, if a comparison may hold good between two countries differing so widely in their institutions as the great republic of North America and the great autocracy of Northern Europe. Kharkof, too, is an intellectual centre owing to its university, established some eighty years ago, and has a small but select circle of literary men, all of them Little Russians in thought and feeling, if not by birth and language, devoted to the best interests of their country, yet fully conscious of the advantages it derives from forming part of Great Russia. I should say that at Kharkof the prevailing feeling is that Mosco must be regarded, for the present at all events, as the mother of Slav nationalities, however much like a stepmother she may at times behave. This feeling may be attributed to the large admixture of Great Russians in the population of Kharkof, and to the material prosperity everywhere apparent, balancing and keeping in check those tendencies which are apt to develop in a purely intellectual society. At Kharkof Little Russians are brought into close contact with their fellow-Slavs of Great Russia, lose gradually their distinctive habits and customs, their language and dress, and assimilate themselves with Great Russians.

There is in the Tivoli Garden at Kharkof a national Little Russian summer theatre—the only one at which the national drama is allowed to be put on the stage. The troupe of actors who play here are not, strictly speaking, professional; their founder Krapivnitsky, however, is well known as a play-writer and actor. He has adapted and placed on the stage the poems of Shefchenko, Kotliarefsky, and others—poems illustrative of Little Russian life and history.

From Kharkof I made an expedition to "Sviatiye Gori," the "Holy Hills," a monastery 100 miles south-east of that city on the right bank of the Donets. This monastery has a reputation in Southern Russia second only to that of the Pecherski Lavri at Kief, which it resembles in many respects. I had intended driving thither by road, passing through some of the most interesting districts of the government of Kharkof—the "Slobodskoi Ukrain" of former years; but not having met with a travelling companion I decided upon going by rail to Slaviansk, only 12 miles from the monastery.

Five hours' journey by train landed me early in the morning of the 26th May at the station of Slaviansk, where I hired a light carriage and pair of horses to take me to the Holy Hills. Slaviansk, anciently known as Tor, after a people of that name, is famous for its salt-works and baths. The former reminded me of Northwych, and of my visit there

last year in the company of an excursion of this Association. The brine is pumped from a depth of 300 feet into reservoirs, where it is evaporated in the usual way. The road to the monastery lay through a cultivated rolling plain, formerly steppe or prairie covered with long grass, where the nomad Tartar loved to roam, and the Khans of the Crimea led their armies to pillage and lay waste Muscovy. The traveller is reminded of these earlier inhabitants of Southern Russia by their burial-places, frequent mounds or burrows—the so-called *kurghans*—raised some fifty or sixty feet above the plain, and forming conspicuous objects in the landscape.

While on the subject of these mounds, let me say a few words on the results of the recent excavations that have been made in various parts of Russia. At Mosco, in the new Historical Museum, several halls are devoted to the exhibition of the various objects collected by the late Count Uvarof and others, and arranged according to the epoch to which they refer. Here may be seen implements of the stone, bronze, and iron ages, together with models of the tombs, showing the position of the skeleton, and the various arms, ornaments, and vessels found with it. In this way we are led to form a more or less correct idea of the manners and habits of these early races of mankind, and to depict them in imagination. Attempts have even been made to portray primeval man and his surroundings in the large fresco paintings adorning these halls by the eminent artists Semiradsky and Vasnetsof.

At Kief, at the University of St. Vladimir, there is an interesting collection of these remains, arranged by Professor Vladislaf Antonóvitch of that University. These refer chiefly to the excavations made in the south-western provinces of Russia, and in order to give some idea of the number of these ancient burial-places, I may mention that in Volhynia alone it is estimated there are 35,000 of them, while in the Government of Kief there are probably a great many more. Were it not for these curious mounds the whole country I was travelling through would be one vast uninterrupted corn-field, except where the rotation of crops and the necessity for providing pasturage for the herds leave gaps in the endless extent of rye, wheat, barley, and oats, promising then, what has been realised since, a most abundant harvest. Amid all this extent of corn-land there is hardly a tree to be seen, except where the Government or some wealthy landowner have preserved the forest. The peasant, intent only on bringing more land under cultivation, and providing for an ever increasing population, cuts down every stick of timber, while many of the less wealthy landed gentry, equally reckless and improvident, convert it into money, selling their trees to contractors, who fell them and saw them up for materials for the railway companies. I passed troops of pilgrims on their way to the Holy Hills, this being the season when they are able without inconvenience to absent themselves from home and field work, and enjoy what to them is a great pleasure—a religious outing. Some were tramping along the road, others were resting by the side of a well to partake of their midday meal. They were mostly women—a sun-burnt, dust-stained, poorly-dressed people, looking as though, amid

all this plenty, they had barely the wherewithal to keep body and soul together. The men wore rough coats of home-spun, the women were literally in rags, with bare feet, carrying their boots and a sack, probably containing their smartest dress, slung over their backs. They all bowed as I drove past, the men uncovering their heads.

The view of the valley of the Donets, just before descending to the monastery, is beautiful. Thick woods, containing many varieties of trees, border the right bank of the river and clothe its steep slopes, almost hiding from view the churches and buildings. Below flows the river, a tranquil stream about 100 yards wide, and beyond, on its left low bank, are woods and meadows for many a mile, with occasional homesteads and a few more pretentious-looking houses.

It is not known with any certainty when the monastery was founded. Some believe it to have originated as early as the 9th century, when saints Cyril and Methodius were sent to convert the Khazars. But the generally accepted tradition is that it was first founded by refugees from Kief about the time of the invasion of the Tartars in the 13th century. Herberstein[1] mentions the name in the early part of the 16th century: but says nothing of any monastery, which probably was not then known, though the locality was famous as an advanced post against Tartar aggression, and to observe the movements of the Krim. Whoever its founders may have been, they displayed marvellous ingenuity in tunnelling the chalk cliffs and hiding their places of worship underground. Here many an escaped prisoner from Krim, Nagai, and Tartar, found refuge; here, too, in later times refugees from Polish oppression and the Uniat propaganda joined the brotherhood. Hither came to pray the Don Cossack in the intervals of fight, and the wild Cherkess robber sought, though sometimes in vain, sanctuary. The monastery became famous for the sanctity and asceticism of its inmates, as well as for the services it repeatedly rendered to Prince, Grand Duke, and Tsar. Lands were given it, and many serfs. But when the fear of Tartar and Polish invasion had passed away, after Peter the Great's campaign against Azof had cleared the southern borders of Russia of enemies, and the Empress Catherine II. had ascended the throne, hard times were in store for the monastery of the Holy Hills. The monks relate that in 1787, when they were expecting a visit from her Imperial Majesty, then on her way to the Crimea, they had to receive a very different guest in the person of her viceroy, Korbe, who made an inventory of all their possessions, and placed guards over them. Ten months later the monastery was closed, its lands sequestrated, and the monks sent away. Thus it remained for about fifty-six years, at the expiration of which time it was reopened by the Emperor Nicholas in 1844. During this time "this paradise on earth," as Potemkin calls it in his letter to the Empress, begging her to bestow it on him, became his private property, and its cathedral was turned into a parish church. But the people continued to resort in thousands to the shrines, attracted by the miracle-working *ikon*, or image of St. Nicholas, and the reputed sanctity of the place.

[1] Cf. Notes upon Russia (Hakl. Soc. Pub.) ii. 13.

My visit was well-timed, for I happened to arrive on the anniversary of its first abbot, Arsenius. The large quadrangle was crowded with human beings and a few vehicles. Here were Little and Great Russians, White Russians from the forests of Minsk and Mohilof on the Upper and Central Dnieper; inhabitants of New Russia from the steppes of Ekaterinoslaf, Kherson, and Odessa; Cossacks from the Don, from Taganrog, Rostof, and Nikolaief; and among them a party of Greek women, distinguished by their classic headdresses. Several thousand people were assembled here, mostly of the peasant class, with a sprinkling of officers and ladies from Kharkof and Slaviansk. A happier, better-tempered crowd it would be difficult to imagine. Their wanderings were for the time ended, and, refreshed and rested, they were ready to pay their devotions at the shrines.

I hardly expected to find a corner in which to pass the night, and was agreeably surprised when Father Andrew placed at my disposal a good-sized, clean room overlooking the quadrangle. To my inquiry for dinner he remarked, "You will not like our monastery fare, but, such as it is, you are welcome to it;" and presently another of the brethren brought me a plate of unsavoury soup, macaroni with fish roe, a slice of black bread, and a decanter of excellent iced kvass.

Of the four days in the year, when the so-called "holy place" is open to the public, the day of my arrival happened to be one, and I availed myself of the opportunity to see it. A row of about twenty minutes in one of the monastery boats landed me at the foot of the high right bank about one mile above the monastery. Ascending by a steep foot-path, I entered the enclosure by a gateway, where my companions prostrated themselves. Higher up is a chapel and cells to accommodate twenty-three monks, who live here all the year round, secluded from the world. Above them rise almost perpendicular cliffs, around is the silent forest, and the only easy access to them is from the river.

The most interesting part of the monastery is the long subterranean passage hollowed out of the chalk, leading to the summit of an isolated hill about 250 feet high, on which a church has been erected. This passage, entered from a door opposite the entrance to the cathedral, opens on to chapels, cells, and chambers cut out of the chalk. "See how wonderfully the Almighty prepared the work for our use," remarked the guide to a party of pilgrims, among whom I was one, following him with lighted tapers, as he directed our attention to a row of flints glistening in the chalk. In one of the cells a recluse passed seventeen years, only issuing from his prison twice a year to gaze from the summit of the cliff on the world he had abandoned. He wore next his skin heavy iron plates, and always lay in his coffin. This man, who was of the lower classes, died only about twenty years ago, leaving a reputation of extraordinary sanctity which still attracts thousands every year to his cell and tomb near the altar of the hospital chapel. Miraculous cures are said to have been performed by him during life, and by his mantle after death. Before leaving I called on the Abbot, Father Herman, an intelligent, well educated man, who received me courteously, invited me to lunch, and gave me some information about the monastery.

My next halting-place was Poltava, whither I travelled by rail. Poltava lies in the midst of an agricultural region, rather out of the way of modern improvements. Its inhabitants are of the old-world type, the even tenor of whose lives is undisturbed by stirring events. Some years ago it was proposed to take the railway up to the town and build a station there, but the municipality declined contributing £3000 towards this object, and would have preferred having no railway at all. The traveller, therefore, stopping at Poltava, must be jolted over two miles of bad road before reaching his destination. Though well situated on heights commanding the Vorsklo, Poltava is a dreary-looking town, with its vast grass-grown squares, its wildernesses of gardens, and its empty, glass-fronted warehouses, only used during the fair held here in July, when a large trade is done in corn, wool, and horses.

Nevertheless, Poltava may be correctly described as the heart and soul of Little Russia. Geographically forming part of the basin of the Dnieper, its associations carry one back to the times of the hetmans and the most flourishing epoch of Little Russian history, when the people, having revolted against Polish oppression, threw in their lot with Mosco and hailed her as their deliverer from tyranny and Roman Catholicism. The whole government of Poltava is classic ground; there is hardly a town or village that is not in some way connected with the struggles between the Polish and Russian parties in the seventeenth century, while the valleys of its three rivers, the Vorsklo, the Psiol, and the Sula, are immortalised in the novels of Gogol and the spirited poems of Shefchenko.

I had intended making a tour in the Poltava Government, and my friends had kindly sketched out an itinerary for me through the most interesting places and the prettiest scenery, but owing to the mistaken zeal of a low-grade police official I was only able to carry out part of my programme. Knowing by experience the difficulties of travelling in Russia for persons not furnished with special permits, or passes, I called on the Governor, General Yankofsky, but he would do nothing to help me beyond allowing me to show his visiting card. This functionary, I believe, is much disliked. He is the uncompromising foe to local institutions and self-government, and appears to be placed in his present position to enforce strict obedience to military law, and impersonate the retrogressive policy now in the ascendant.

Having nothing to detain me at Poltava, and having visited the monument erected to commemorate the victory over the Swedes, I hired a light carriage to take me to Dikanka, about seventeen miles off, the seat of Prince Kochubey, whose well-known hospitality procured me a night's lodging. In the absence of the owner, his head steward received me most courteously, and offered to show me any part of the estate and establishments that I might be interested in. I was shown over the mansion, and saw the relics of the founder of the family, the celebrated Cossack Colonel, beheaded by order of Peter the Great at the instigation of Mazeppa. I drove through the forest, with its stately oaks, elms, and beeches, preserved by the foresight of the late owner; I visited the saw-mill and the brewery, managed by a Prussian and worked by Volhynians. There is good sport at Dikanka, for the woods harbour foxes in abundance,

besides roe deer, wolves, and badger; in the open country partridge, quail, snipe, and duck are plentiful, and the large bustard is so fat in autumn that it may be ridden down on horseback and knocked over with the whip.

From Dikanka I continued my journey to the large settlement of Oposhnia, containing several thousand inhabitants, of whom many are engaged in home industries. Oposhnia pottery is famous throughout Russia. The blue clay used for it costs the potter 1s. per load. His materials are the potter's wheel, a stove for baking his moulds, and three simple mineral colours. With these he produces the *miska*, or common earthenware deep plate, used in all the cottages, jars and pots of all shapes and sizes, besides a variety of other articles. Occasionally, when he has time to spare, he will reproduce some elaborate design, which usually takes the form of a drinking-vessel. The people of Oposhnia have never been serfs. Descended from free forefathers, their carriage is more independent than that of their less fortunate countrymen. They are a peaceful, orderly people, but have one ground of complaint in common with all the towns and villages in these south-western provinces of Russia, viz., the overwhelming number of Jews. Not long ago the feeling at Oposhnia ran so high against the Israelites that the authorities had difficulty in quelling it, and only succeeded by persuading the people that their best course was to abstain from buying at the Jewish shops. Nor is this to be wondered at, considering how the Jews have overrun all this region, till there is hardly a town or village without its Jewish population. They begin in a sly, underhand way, getting the trade into their hands, and finish by ousting the natives from their occupations and employments, obtaining possession of the land, and occasionally amassing great wealth.

It would astonish many of my audience were I to tell them how cheap provisions are at Oposhnia. With beef and mutton at 1½d. to 2d. per lb., fowls at 6d. per pair, rye flour at ¼d. per lb., eggs at 5d. per dozen, and servants' wages at 6s. a month, living here is wonderfully inexpensive. Doubtless this arises not only from the abundance of all articles of food, but from the fact that the masses of the people live mainly on bread and vegetables. The place of meat is taken by spirits, which are drunk immoderately.

Having hired horses to take me to the village of Sorotchnitsi in the next valley, and that of the Psiol, about forty miles to the westward, I started again on my travels. I had arranged to deviate from the direct road in order to see something of the curious sect known as the "Stundists." Stundism owes its origin in Little Russia to the German Mennonite colonies on the Lower Dnieper, and is completely at variance with the Russo-Greek Church, recognising none of its sacraments, priesthood, or ceremonies. Stundists read the Bible, abstain from wine and spirits, and are commonly reported to live better than their orthodox neighbours. The persecution of which they have been the victims has driven many of them from their homes, and has probably been the cause of their adopting extreme views. Their numbers are said to be increasing.

It was late in the afternoon that, after a long drive across the steppe, I reached the village of Kovalefka where, according to my informants, the "Shalaputi," as the Stundists are called by the peasantry, are met with. Stopping at one of their houses, I had leave to enter. Its owner was evidently a well-to-do person, but there was nothing to indicate the sectarianism of its inmates. I asked the servant who brought me some tea if I might see her master, and was invited into an inner room, where I found a man of striking appearance reclining on a couch. He excused himself from rising on the score of illness, and bade me welcome. He would accept no money for the hospitality offered, saying he was glad to see an Englishman under his roof. Our conversation began to turn on religious matters, when the local policeman, entering, put a stop to our interview, and the only thing to be done was to leave.

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Little Russians generally offer several points of contrast to Great Russians. Physically they are finer men and handsomer women. The Guard regiments are mostly recruited from these south-western provinces. They are the best fighting men and most intelligent in the Russian army. Little Russians are enterprising colonists. When too crowded at home, or dissatisfied, they start for other lands, no matter how far off, whether beyond the Volga only, or to the borders of China. Long trains of their carts, each yoked to a pair of oxen, may be seen carrying all their worldly possessions across the deserts of Central Asia, the philosophical "Hohol," as he is called, plodding alongside till he find a climate and a soil to suit him. In their social and political tendencies Little Russians offer a still greater contrast to Great Russians. While these latter favour communal tenure and are attached to the patriarchal family life, the Little Russian is all for individualising property and severing the family tie. As soon as the sons grow up and marry, they form separate households, and it is a common thing to see detached farm-steads—the so-called "hutori"—dotted over the plain. In earlier times Little Russians had their "gromada," answering to the "mir" of Great Russia—the village assembly or parliament at which local affairs were discussed. Now all these institutions, and everything tending towards freedom of thought, are sternly repressed by the police. Little Russians have been frequently accused of laziness, but this is unjust, and arose from their disinclination to work for masters who never paid them for their labour. They could not reconcile themselves to serfdom, unknown among them till the Empress Catherine II. introduced it, and her grandson Nicholas hated them for their independent spirit.

Descended from the Cossacks, who were attached to democratic institutions, and whose only title to eminence arose from personal bravery in battle, the Little Russians after joining Russia found themselves compelled to acknowledge and serve under a landowning aristocracy composed for the most part of their equals, whose elevation was due to their happening to be in authority at the time of the rebellion against Poland in the seventeenth century when Little Russia, led by Bogdan Khmelnitsky, joined hands with Great Russia. The present aristocracy of landowners is descended for the most part from the colonels and hetmans of that period.

SEA-TEMPERATURES ON THE CONTINENTAL SHELF.

(*Read at Meeting of British Association, Bath*, 1888.)

By Hugh Robert Mill, D.Sc., F.R.S.E.

During July and August 1887, at the request of the Fishery Board for Scotland, I undertook a physical examination of the water to the north-west of the island of Lewis on board H.M.S. *Jackal*. Full details of the methods employed, and a complete record of the observations made, illustrated by a large-scale bathymetrical chart of the district, temperature curves, and coloured temperature sections, have been published in the Annual Report of the Board for 1887.[1] The main conclusions arrived at appear to be of some general importance in relation to the theory of submarine temperature and of ocean circulation, as affected by configuration and wind, and are here reproduced.

The term "continental shelf" is applied to the shallow portion of the continental slope, lying within the 100-fathom line, which is usually terminated seawards by a very abrupt descent to abysmal soundings.[2] The British Islands rise from one of the widest portions of the continental shelf, which is diversified by numerous deep narrow troughs or channels ploughed out by glacial ice, and by submarine banks sometimes crowned by islands. The configuration is extremely accidented, and the tidal currents are correspondingly irregular, leading one to expect like diversities in the distribution of temperature and salinity.

The *Jackal* spent a month in examining the conditions of the region on both sides of the island of Lewis, and seaward to the 100-fathom line. In describing the submarine configuration of the region, any portion rising nearer the sea surface than 50 fathoms may be termed a *bank*, and for convenience the various banks are named (when there is no more familiar designation) after the principal island upon them.

The *Outer Hebrides Bank*, or *Great Bank*, extends parallel to the coast of Scotland for 130 miles,[3] from 5 miles north of the Butt of Lewis (38 miles west of Cape Wrath) to 10 miles south of Barra Head (52 miles west of Ardnamurchan Point); in width it varies from 30 to 15 miles, averaging 25. The northern half of the bank is slightly the wider, and runs NE. by E. and SW. by W. (magnetic), while the southern and narrower half extends nearly NNE., and SSW. The eastern margin of the bank facing the Minch closely follows the general outline of Long Island at a distance seldom greater than 2 miles. The western margin, on the other hand, runs nearly parallel to the eastern, only approaching within 2 miles of land at the widest part of Lewis, and lying off 23 miles west of the Butt, 8 miles west of Loch Carloway, 15 miles west of Taransay in West Loch Tarbert, and 10 miles west of Barra Head. The 30-fathom line lies about 5 miles within that of 50 fathoms on the west side of the Great Bank, and usually less than half a mile on the east side.

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[1] *Report of the Fishery Board for Scotland for* 1887, *Part III. Scientific Investigations.*

[2] J. Y. Buchanan, *Scot. Geog. Mag.* iii. p. 217.

[3] The miles used throughout this paper are nautical miles, 60 to the degree.

It is to be noted that the lochs and sounds indenting and separating the islands are all very shallow, in marked contrast to the deep rock-basins of the mainland. The Great Bank carries a chain of islands, the Outer Hebrides, on its eastern margin, where the slope to comparatively deep water is steep. The Minch, which separates the Great Bank from the mainland, has a very irregular configuration, but its depth exceeds 70 fathoms only at a few points; and the two Shiant Banks are small areas less than 30 fathoms deep. In the Little Minch the depth is generally over 70 fathoms, and further south this increases to beyond 100 fathoms along the eastern margin of the Great Bank in a narrow isolated depression 31 miles long, and from 1 to 5 miles wide, where the maximum depth is 132 fathoms.

The *Flannan Bank*, as defined by the 50-fathom line, is about 42 miles long and 14 wide, running parallel to the northern half of the Great Bank between Loch Sheabost in Lewis and the Sound of Harris. It is separated from the Great Bank by a channel about $3\frac{1}{2}$ miles wide and 72 fathoms in maximum depth. The form of this bank appears not quite correctly laid down on the Admiralty chart, where it is shown connected with the Great Bank off Gasgeir. The separation indeed is of very slight importance, as at that point the depth is only 52 fathoms, but physically the channel seems to be continuous. In the north-west of the bank an area 12 miles by 7 comes within 30 fathoms of the surface, and here the group of the Flannan Isles or Seven Hunters is situated.

The *St. Kilda Bank* is 7 miles in diameter, and roughly circular; its eastern margin lies 10 miles west of the south-western point of Flannan Bank, and the group of islands (St. Kilda, Soa, Borreray) rises abruptly from a considerable depth.

To the north of the Great and Flannan Banks the depth increases very gradually to 70 fathoms, the fall being at the rate of 1 fathom in a mile, then abruptly to over 100 fathoms, the average rate being about 40 fathoms per mile. West of the St. Kilda Bank the depth increases rapidly to 70 fathoms (at 35 fathoms per mile), then gradually to 100 (at 2 fathoms per mile), after which there is a comparatively gentle descent to oceanic soundings.

The configuration of the continental shelf, west of Long Island, may be summarised by stating that north of a line drawn from Loch Carloway in Lewis, through the Flannan Islands westwards, there is a wide terrace of about 55 fathoms in depth, terminated shorewards by a sudden rise into shoal water, and seawards by an abrupt descent into oceanic soundings. South of that line there is a rapid descent from the margin of the banks to about 80 fathoms, then a wide terrace extending to the 100-fathom line, where a moderately steep slope seaward commences.

From four observations made in the Minch, the average salinity of the surface-water appeared to be 3·473 per cent. of salts (corresponding to a density of 1·02586 at 15°·56 C.), and that of the bottom water 3·479 (1·02591). Fifteen observations on the west side gave an average salinity of 3·505 (1·02614) for surface, and 3·509 (1·02617) for bottom water. On the whole, the sea seemed to be slightly freshened within five miles of the land, and to be a little salter in the northern

than in the southern half of the region examined, but the observations are not sufficiently numerous nor the variations sufficiently pronounced to admit of a chart being constructed illustrating the distribution of salinity. Considering salinity alone, it would seem as if the north-westerly wind, prevailing at the time when the observations were made, carried in salter water from the Atlantic, driving the fresher surface water over the bank, and heaping it against the shore, causing its return as an under-current. This is confirmed by the observations on temperature. The water on the west side of Lewis is decidedly salter than that in the deep rock-basins (sea-lochs) of the west coast of Scotland or in any part of the North Sea.

Serial observations of temperature were more numerous than determinations of density; the following table generalises the result:—

TABLE I.

Temperature of Water in Degrees Fahrenheit.

PLACE.	Surface.	10 fathoms.	20 fathoms.	30 fathoms.	40 fathoms.	50 fathoms.	60 fathoms.	70 fathoms.	90 fathoms.	100 fathoms.
Flannan Channel, . .	56·7	56·3	55·7	54·6	53·5	52·2	51·9	...	...	...
Flannan Bank, . . .	55·9	55·6	55·1	53·3	52·0	...	...	...	...	...
Seaward of 50-fathom line, .	56·9	56·5	55·9	52·3	50·6	49·8	...	48·7	48·3	48·0
General, ...	56·7	56·3	55·6	53·3	51·7	50·6	49·1	48·7	48·3	48·0

The last line gives the average for all observations made in depths exceeding 40 fathoms.

The most striking difference that appears is that the crest of Flannan Bank is covered with colder water than occurs either in the Channel or to seaward at the same depths, the difference being about 1° for the first 10 fathoms. It also appears that in the Flannan Channel the temperature after the first 10 fathoms sinks with considerable uniformity from surface to bottom, whereas in the open sea beyond the 50-fathom line there are three distinct zones, one of nearly uniformly warm water near the surface, one of rapid transition, and one of nearly uniformly cold water. These zones, as shown by the form of the curve of vertical distribution of temperature, are found more or less distinctly in all the deep observations, although the thickness varies in each case.

The surface-water was found to be rather cooler than in the enclosed basins of the Clyde sea-area at the same season; but the bottom water was several degrees warmer than that of enclosed basins of equal depth. The form of the curves of vertical distribution in the two cases is dissimilar.

An August curve of temperature in the Arran Basin in 104 fathoms resembles a portion of a hyperbola convex to the vertical axis; the surface water is warmest, and as the depth increases, the water becomes

cooler more and more slowly to the bottom. In a typical curve for the region just seaward of the 100-fathom line, in August, temperature is highest at the surface, but remains practically constant for the first 20 fathoms; then falls with increasing rapidity as the depth increases to about 35 fathoms giving to this portion of the curve a form concave to the vertical axis; at 35 fathoms the rate of fall of temperature becomes less, and grows less and less as the depth increases, giving to the lower portion the convex form common for sea-lochs. This, according to the 'Challenger' results, is typical of the upper few hundred fathoms of the Atlantic Ocean, and simply means that two layers of water, each at a nearly uniform temperature, are in contact, and the zone of rapid transition of temperature marks the mingling of the two masses. The shorter the concave portion of the curve the more closely in contact are the two strata of unequally warm water. As a rule at stations west of the Flannan Bank the rapid change of temperature was found at a depth of about 25 fathoms; on the bank itself the temperature was nearly uniform throughout, and in the Flannan Channel the lower mass of uniformly cold water scarcely appeared. The depth and thickness of the zone of rapid change were affected remarkably by the direction of the wind.

TABLE II.

Wind Blowing on Shore.			Wind Blowing parallel to Shore.			Wind Blowing off Shore.		
Station.[1]	Depth of Stratum of Constant Temperature.	Thickness of Zone of Rapid Change.	Station.[1]	Depth of Stratum of Constant Temperature.	Thickness of Zone of Rapid Change.	Station.[1]	Depth of Stratum of Constant Temperature.	Thickness of Zone of Rapid Change.
	fms.	fms.		fms.	fms.		ms.	fms.
J	25	25	H	20	20	G	35	...
K	15	10	M	25	...	I	8	6
L	25	20	N	24	5	W	19	10
P	47	12	O	43	...	*c*	22	18
Q	35	15	X	15	10	*d*	20	9
R	24	6	Y	0	30	*e*	47	...
S	25	5	*a*	20	10	*f*	34	...
T	20	20	*b*	25	10	*g*	25	...
U	31	...	Mean	$21\frac{1}{2}$	14	Mean	26	11
V	20	35	of cases,	8	6	of cases,	8	4
h	27	...	Mean			Mean		
i	30	30	omitting	$24\frac{1}{2}$	11	omitting	23	11
j	40	10	Station Y,			Station *e*.		
k	30	20						
Mean of cases.	28	17						
	14	12						

[1] These stations refer to the chart published in the Fishery Board Report, *loc. cit.*

Table II. illustrates this effect by bringing together all the stations where observations were made, and classing them according as the wind is blowing directly on shore, parallel to the shore, or off shore. It thus appears that when the wind blew in from the Atlantic and drove the waves directly against the coast-line the greatest amount of water at a uniform high temperature was found as a superficial stratum, and the zone of rapid change was at its thickest, while when the wind was blowing parallel to the coast or off the land the stratum of constant temperature was less and the transition to colder water more abrupt. During the period of the observations the general condition was a sea-breeze which would tend to bring the whole of the water bordering the west side of the island into an "on-shore" state, and so prevent the occasional puffs of off-shore wind from producing the full effect they might accomplish if they had blown for a few days or weeks at a time. The sea was almost always rough, and in the absence of additional data we may assume that the remarkable layer of 23 fathoms of water at the uniform warmth of 56°·3 was due to the agitation of the surface-water, and the consequent mixture, the leading agent in effecting this being the heaping up of the warm surface-water against the coast by the prevailing wind, and its setting back as a slow under-current, mixing with, or displacing the colder water with the exception of a few fathoms in the deepest parts of the Flannan Channel. The mean temperature of the air, calculated from the observations made twice daily, was 56°·6, and there were no great departures from this value; the average morning observations giving 57°·7, and of evening ones 55°·6.

Three sections at different parts of the region were made from the coast to a position from 50 to 80 miles seawards. In the northern part, where the 55-fathom terrace extends to the shore uninterrupted by the Flannan Bank, one series of soundings brings out how the surface-water striking against the steep land-slope is deflected downwards to a greater and greater depth as the land is approached, pushing back the colder water so that the isotherms, instead of maintaining the horizontal position seaward of the broad shelf, dip landwards at an angle of 45° as shown on the exaggerated scale of the section; (vertical scale = 400 times the horizontal).

Another section further south, from beyond the hundred-fathom line, passing just north of the St. Kilda Bank, shows the simultaneous action of the abruptly rising slope of the eighty-fathom terrace to the Flannan Bank, in heading back and mixing the lower layers of water, while the driving up tendency of the upper part of the slope reduces the surface temperature, and mixes the water in the manner already described. Here the Flannan Bank is seen to act as a continental slope on the main mass of water, and as a superficial shoal on the upper layers. Nearer Lewis than the Flannan Bank, on the crest of which the coolest surface-water was found, consequent on the upwelling of the lower layers, there is a channel of colder water, and even the superficial layers are cool.

The longest section carried still further south from twenty miles seaward of St. Kilda, cutting across the southern end of the Flannan Bank to the shore at Loch Hamanavay again shows the massing of warm water against the land; referred to the most northerly section. Cold water

appears at the bottom of the Flannan Channel, and this has come round the south end of the Bank, and was caught just disappearing as a narrow thread on the bottom in the depression off East Loch Roag, twenty-one miles further north. The effect of the Flannan Bank on surface temperature is quite plain, but not so accentuated as that of the St. Kilda Bank, which raises colder water towards the surface and brings the isotherms to a higher level than in the previous section, while the projection of the shoulder of the Flannan Bank secures them an almost horizontal run until near land, where they dip down as in other cases.

Viewing the isotherms on these sections as limiting a series of sheets of water at different temperatures, we may compare the effect of the complex mass striking land to a thick pamphlet struck edgewise against a vertical board; some pages representing the isotherms would be bent downwards, others upwards.

The work done on the *Jackal's* cruise of August 1887 showed that the margin of the Atlantic on the 100-fathom line was composed of two layers of water, alike in salinity, but differing in temperature; the upper layer, 25 fathoms deep, was throughout above 56°, the lower layer, at least 60 fathoms thick, was of the warmth between 48° and 49°, and they were separated by a zone of about 15 fathoms, where the upper layers of the colder water mixed with the lower layers of the warmer. This, taken in conjunction with the configuration of the sea-bottom, the set of the tides, and the prevailing winds, as already discussed, enables a very simple explanation to be given of the physical conditions of the region. Considering the superficial 100 fathoms, we may picture a sheet of 30 fathoms of uniformly warm water laid directly over the mass of uniformly colder liquid below, and this condition extending right on to the land. When no disturbing causes act there is an abrupt transition between the two layers, but the heaving of the surface into long swells, and the ruffling into waves set up a sliding and stirring that soon effect a certain amount of mixing at the plane of contact, and the set of the surface-drift due to wind and tide produces in addition a shearing motion, the warm skin slipping over the cold body, and when it strikes a shoal moving on unimpeded by the land. Hence there is a tendency for the surface-water to accumulate against a lee shore, and as change of level cannot take place, there is a back underflow seawards from the land, the warm surface-water being driven downwards against or through the deeper cold zone. This is clearly proved by the greater length of the straight and concave portions of the curve of vertical distribution for stations near the shore of Lewis. The effect of banks upon the onward drift of the compound mass is different. The surface-water passes on, the lower layers are checked and partly driven backwards, somewhat raising the temperature in greater depths seawards; partly it is driven up the slope, producing a more uniform and lower temperature on the crest of the shoal, and thinning or pushing aside the veneering of warm surface-water, thus maintaining also a lower temperature in the channel on the landward side of the bank.

The theory of the influence of wind in ocean circulation recently brought into prominence by the observations of Dr. John Murray is fully supported by the results discussed in this paper.

GEOGRAPHICAL NOTES.

ASIA.

New Route to Tibet.—Captain H. J. Elwes, at the meeting last month of the British Association, read a paper on a new route to Tibet, which he had intended to read at the Manchester meeting last year, but which, owing to the military operations now in progress in Sikkim, has perhaps more public interest at present. He pointed out that the present route from Calcutta to Tibet, *viâ* Darjiling and the Jalapla (Jeylep), had the great disadvantage of crossing three deep hot, unhealthy tropical valleys and of making a long detour from Jalpaiguri to reach Darjiling. The distance from Jalpaiguri to the Jalapla by the present route is estimated at about seventy-eight miles by railway, entailing a break of gauge at Siliguri, where the Himalayan Railway begins, and about eighty-four miles by road, on two-thirds of which good fodder and grazing for beasts of burden is difficult or impossible to obtain. The total ascent in this route to the Jalapla Pass, which is about 14,000 feet above the sea, is about 28,000 feet, of which the loss by descents is at least 13,500 feet. The number of days taken to reach the pass by this route is nine or ten, and the difficulty of maintaining the road in the rainy season in a condition fit for troops and transport is very great. A divergence from the route has been proposed by Mr. Paul which leaves the present route near Rhenock, but does not offer the same advantages as a through route from Bengal to Tibet as the one proposed by Mr. Elwes. This was also considered by Colonel Tanner, late superintendent of the survey operations at Darjiling, as the shortest and easiest natural route across any part of the Himalayas, and has these two great advantages—namely, that at the very point where the existing British frontier approaches the Tibetan frontier most nearly the natural obstacles are also the smallest, as no river has to be crossed on the whole route, and the distance is not only shorter by about fifty-four miles, but also effects a gross saving of at least 10,000 feet to reach the same point. Mr. Elwes described his proposed route, which crosses the Tista River at Jalpaiguri, and then proceeds by a tramway to the foot of the hills at Bulaban or Jungi Guard. This tramway, being greatly wanted for the transport of tea and other produce by the large and rapidly increasing population of the western towns, would probably pay for construction for local purposes only, while if it was continued, by a hill-path suitable for ponies, to the lake and over the Tista Lake, a spot about 10,000 feet above the sea, it would join the existing route near the fortified camp at Gnatong; and pass through a country which at present is an uninhabited jungle, but which might easily be converted into a flourishing country if the restrictions placed on its settlement were modified. Mr. Elwes then went into details of his proposed route, comparing it, by means of a diagram, with the existing one, to show more clearly the difference, and concluded by alluding to the political difficulties which had so long impeded the increase of the trade between Tibet and India. He then spoke as to the military and strategic importance of the Chindwin Valley, which runs like a wedge into the Himalaya between Bhutan and Sikkim, and which, though it is considered as an outlying part of Tibet, is, geographically, a *cis*-Himalayan valley. He also alluded to the importance of encouraging emigrants from Nepal, who have colonised British Bhutan, and are the best forest pioneers in India, to form colonies round our north-eastern frontier, which would not only act as a buffer between the plains and the savage tribes which inhabit the hills, but gradually increase and form a splendid recruiting ground

for the Nepalese regiments which had taken such a distinguished part in all our frontier wars, and who were so useful both in the police and other departments in Assam.

Recent Surveys in the Indian Ocean.—We have already shortly noticed the report by Commander Carpenter on the Indian Marine Survey, and now add a summary of the valuable work accomplished by that officer and his assistants in the surveying ship *Investigator* during the season 1887-88, a work which has resulted in several changes of importance being made on the charts, as well as the collection of much data, useful alike to the geographer and to the voyager in the Indian Ocean. In March 1887 the *Investigator* left Madras, and sounding on the South Patches, off the mouth of the Megna River, found least water in 7 feet, and this depth has been restored to the charts, after having been superseded for a time by that of 2¼ fathoms. Thus the accuracy of Pearson's survey of 1867 has been confirmed. These Patches have been the cause of numerous wrecks, caused, as Commander Carpenter points out, by the fact that sailing vessels arriving off Chittagong, often with chronometers in error after long voyages, have either run upon these shallows, or, in attempting to avoid the danger, have given them too wide a berth, and run upon the Megna Shoals. From the corrections now made upon the charts, ships may feel their way and clear the dangers off Chittagong by the use of the lead and ground-log only. Another work undertaken by the Survey, and likely to result in further safety to navigators, is the rectification of the prominent landmarks of the Andaman and Nicobar Islands, which will enable masters of vessels sailing up the Bay of Bengal to take bearings with great precision, and correct their chronometers by observations of the sun. The flats of the Sunderbunds should now prove, it is hoped, less fatal to shipping than was formerly the case. A line of soundings was next made from the neighbourhood of the Patches southward to the latitude of Akyab, whence it was carried, in deep water, towards Madras, the depth gradually increasing till 1,820 fathoms were obtained forty miles off Pulicat. The bottom temperature of the water of the bay was always taken, and so uniform were the readings that Commander Carpenter believes that the thermometer acts as a severe check on the results obtained by the lead, and cites an example where the temperature disagreeing with the depth at a spot between Cheduba and Ceylon on former occasions, another trial was made in the course of the late survey, and the depth previously shown by the lead proved to be false. In addition to these bottom temperature observations, a series of thermometer readings was occasionally made nearer the surface. Trawling and dredging were here resorted to, but the results were meagre and disappointing, the rope used being insufficient to withstand any great strain. The bottom, however, it was ascertained, appears to be covered with a minute sponge and coralline weed. At the request of the Post Office authorities, the Trilupur Reef and Rockingham Patch were next examined, but no change in the charts resulted from the minute investigations of the officers of the survey. It is pointed out that the red light now exhibited at Trilupur ought to prove a great convenience and help to those navigating in the vicinity. The mud-bank reported by the s.s. *Clan MacIntosh* in 1884 was sought for, but without success. After leaving Madras, a sounding of 1700 fathoms was made at a spot where the charts previously represented "5 fathoms, doubtful." The omission of this imaginary danger from the charts will give shipmasters greater freedom in future when nearing Madras. Some useful soundings were made north of Pedro Point, Ceylon, and the tides carefully watched; at the Point the rise and fall were ascertained to be but 2¼ feet.

After all this useful work had been accomplished, the *Investigator* was paid off on 13th May, and the results obtained were worked up at Poona. The actual survey was resumed in October, by a line of soundings being carried from Porbander and the Lakadive Islands. In the middle of the group the *Investigator* was anchored for a night off Chitlac Atoll, where the surgeon-naturalist landed to make a collection, and Commander Carpenter sounded between the anchorage and Kiltan Island, twenty miles distant. In this series the deepest sounding was midway between the islands, where 1300 fathoms were obtained, on a bottom of fine amorphous coral *débris*. North of Cora Divh Bank 1120 fathoms were got, and 1150 fathoms 7 miles north of Elicalpeni Bank. When at Chitlac a curious discovery was made on the inner shore of the lagoon, in the shape of a large wooden tank containing a man's head. It had floated over the reef and stranded in September 1885, and was supposed to be part of the drift wreckage of the unfortunate *Jabree* barque, sunk off Rás-al-Had, in Arabia, in the previous June. The presence of this tank on the atoll appears to Commander Carpenter to point to the existence of a southerly current along the west coast of India. Between Ceylon and the Andaman Islands and in the Gulf of Manaar several soundings were made, the deepest giving 2125 fathoms. In lat. 14° 23′ N., long. 70° 28′ E., 1120 fathoms were found, proving that the Ada Bank, if it exists at all, has been wrongly placed. A more careful and extended search for this shoal appears eminently desirable. Several patches of seven fathoms on dead coral were noted off the south-west point of Little Andaman Island. Port Blair underwent a careful survey by Lieutenant Whitehouse, R.N., and Mr. B. Rajaram. A part of the lands was also surveyed, in the course of which it was ascertained that the banks south-west of Rutland Islands can be safely passed over, but Macpherson Straits and the entrance to Port Mouat require to be buoyed before safe navigation can be ensured. Trawling and dredging were here resorted to with gratifying results, and tide poles were erected on Cinque Islands and on the Labyrinth group. The Western Coral Banks were most carefully surveyed, and the weather being fine, and the water remarkably clear, the water-glass was most usefully employed in checking the lead up to depths of 10 fathoms. The surface of the banks were noted to be generally smooth, covered with pulverised dead coral fragments, with small, scattered bunches of growing coral nowhere exceeding two feet in height. No reef-building corals were observed, and the living specimens showed no tendency to grouping. Commander Carpenter believes that in heavy weather, breakers, or at least high rollers, occur wherever the depth is less than seven fathoms, the sand thus stirred up rendering the conditions unfavourable for growing coral on the shallower parts of the banks which do not lie on the weather side, but this state of matters can hardly account for the absence of reef-building corals on the weather edge. On South Coral Bank the least water was found to be 6 fathoms, and on Middle Coral Bank 23 feet. So clear is the water than in ordinary weather patches of 12 fathoms can be discerned at the distance of a mile, and on a calm day the form of the bottom under the ship can be distinctly traced without the aid of a water-glass in 8 fathoms. West Coral Bank has a length of 25 miles, lies 13 to 15 miles off shore, and the shoalest water yet discovered is 6 fathoms. Deep water is found within a mile or two to the westward of these banks, which lie on the western edge of the Andaman Islands' plateau. In the channel between the islands and the banks no dangers were observed situated more than 4½ miles off shore. The *Investigator*, drawing 13 feet of water, passed safely through Middle Strait, but the east end of Homfray Strait was found to be blocked by a bar covered by 9 feet. Both passages are narrow and winding, but the tides are not strong, and ships of moderate length

can easily steam through them. The natives of the Andaman Islands were found to be most friendly, and showed great quickness in various ways—the facility with which many of them have mastered Hindustani being specially remarkable. This great change in the feelings of the natives has been entirely brought about by the wise administration of Colonel Cadell, and it is much to be desired that the policy so prudently pursued by him may be followed by all who may have dealings with these people in future.

The above forms a slight sketch of the work carried on by the *Investigator* up to April of this year. All interested in geography and oceanography must look forward with interest to the publication of the next report.

AFRICA.

Recent Explorations in the Cameroons.—One of the last blanks in the map of Africa is that bounded on the west by the Cameroons coast, on the east by the Mobangi, on the south by the Ogowé and Likuala, and on the north by the Benué and Shari: territory falling largely under the German Protectorate at the Cameroons, and equal in extent to the German Empire. Following the explorations of MM. Zintgraff, Zöller, Schwarz, Schuckmann, Stubenrauch, and Puttkamer, those of MM. Kund, Tappenbeck, and Weissenborn have pushed still further. The results of these German observations have been gathered together, and a chart embodying them has been published in Part II. of the *Mitt. von Forschungsreisenden*, etc., a summary of the leading facts being contributed by *Le Mouvement Géographique* for 12th August. The following are some of the data supplied:—Of the rivers flowing through German territory the Malinba or Eida, the lower course of which was ascended by Mr. Grenfell, is the most northern. New facts are given in regard to this river, as also regarding the Moanya, which M. Zöller navigated to the first cataract, but to which Messrs. Kund and Tappenbeck have given the two names—Sannaga and Njong.

The Sannaga (or Edéa) debouches on the coast to the east of the island of Fernando Po, and a little south of the estuary of the Cameroons, with which it communicates by an arm, or maringot, called the Kuakua. At about ten kilomètres from the coast the river divides into two branches—the Bornu and Borea. It is navigable for the first 56 kilomètres of its course, as far as the Edéa rapids, which for long has been the extreme known point. Higher up, the river's course has yet to be determined as far as the point recently reached by MM. Kund and Tappenbeck (in about 4° 30′ S. lat., and 11° 50′ E. long.). At this spot the river is impeded by a new rapid, to which the travellers gave the name of "Nachtigal." The Sannaga, with a breadth of 400 mètres, there precipitates its waters from a height of 10 mètres. The surrounding country is 470 mètres above the sea, from which it is distant some 300 kilomètres. The river, coming from the east, probably receives the drainage waters from the south sides of the Adamawa-plateaux. Below the Nachtigal Fall is another fall, and a few kilomètres further down is situated the village of Guataré (4° 43′ S. lat., 11° 34′ E. long.). This village, which was the furthest northern point reached by the German expedition, is under the Mohammedan influence emanating from the Sudan.

As regards the river Njong (or Niong), it flows, under its previously known appellation of Moanya, or Little Batanga, into the sea south of the embouchure of the Sannaga. M. Zöller, who was the first to ascend the Njong, penetrated as far as 40 kilomètres from its mouth, where his passage was arrested by a fall of the river some 10 mètres high. Its course is unknown from this point, for

125 kilomètres, up to the village of Chumma (right bank, lat. 3° 30′, long. 11° 35′), where the river was navigated by the expedition under Lieut. Kund, who ascended it, in a north-east direction, up to Makung (lat. 3° 50′, long. 12° 27′). At this, the furthest eastern point reached, the Njong measures 150 mètres in width. The altitude of the country is 660 mètres above sea-level. From Makung to the ocean the river appears to have a course of 325 kilomètres.

These data (says M. Wauters) enable one to approximately determine the watershed between the basins of the ocean and of the Congo. The water-parting separating the two basins should be found towards the east in about the 14th or 15th degree of longitude. East of this water-parting, as far as the western limit of the basin of the Mobangi, the country probably is drained by the upper course of the Bunga, which should receive the river Jensé which M. Jacques de Brazza saw near the village of Ilocu.

Togo-land and Ewe Territory.—*Petermann's Mitteilungen*, No. viii., 1888, publishes a report of the missionary, Herr E. Bürgi, on explorations carried out by him on the coast of Togo-land, and in the territory of the Ewe tribes. A map accompanies the paper. From these we are able to glean a certain amount of original information, Herr Burgi's journey into the hitherto unknown Nodshie being specially noteworthy.

Former maps of the Ewe territory give one the impression of its being a narrow strip of land stretching into the interior, but in reality it is longer than it is wide : its greatest extent is from west to east (between the Volta and the Amutsu rivers). Herr Burgi's map now shows the extent and limits of the territories coming under German rule.

The whole coastal region resembles a great plain, commencing in the neighbourhood of Akra (Accra), and stretching across the whole Slave Coast eastwards to the Niger ; in the east this plain is wider, the mountains, trending NE., being further from the coast. Herr Burgi has indicated on his map the approximate commencement of the inland plateau, which is scarcely appreciable, except, perhaps, in Togo-land ; he observed the undulating character of the country at Akati, where the land again sinks into the Todshié plain, and again between Aflahu and Togble, and behind Adetikówe. It almost appeared, he says, as if, behind these undulations of land (which extend roughly for sixty miles round Akati, and for some ninety miles round Davie and Agome), there was another plain or sinking of the land, which was clearly observable between Adepta and the Adaglu, and between Tsevie and Atakpame ; in this plain are situated Agotime and Nodshie. The character of the soil of the undulating land is ferruginous, and dark red in colour, but the coastal lands consist only of sand. The narrow strip of land between the Keta lagoon and the sea is nothing but a sand-bank, upon which Keta (Quitta) is situated, and offers a striking illustration of the action of the sea in this district. Between the Keta and Togo lagoons the coast is thickly strewn with sand-dunes, and there are evidences to show that the two lagoons were at one time connected. Herr Bürgi points out, what had apparently escaped Dr. Zöller's notice, that the river Zio flows into the Togo lagoon at its south-western corner, and that the river "Lebe" is actually the mouth of the Zio.

All the large water-courses (*e.g.*, Todshié, Zio, Haho) have their origin in the hills and mountains limiting the plain on the north. They do not deserve the name of "river," as, in the dry season, they are nearly dried up, or at least flow in a very narrow bed filled with trees. The Amutsu, however, seems to be a larger stream : it has its source behind Ana and Kposo, and is said to be

navigable by canoe as far as Togoto. At first, Herr Bürgi thought the Amutsu identical with the Haho, but he was informed by Pater Ménager in Agué (near Little Popo), that the river flows into the sea near Great Popo under its proper name of Amutsu. A journey of a colleague down the river confirmed this information. The Lili is a tributary of the Haho, and unites with it a short distance before flowing into the Togo lagoon ; but the Lili is not a stream of any importance. Herr Bürgi was not able to discover the sources of the Haho.

The characteristic representative of the vegetable kingdom on the coast is the coco-palm, which is found in great numbers round every native village. Beyond the lagoons, in the undulating country before mentioned, the country is park-like. Actual forest Herr Bürgi found only in Ewe, round Davie and Darave, where the oil palms and silk-cotton trees (*bombax*) are so thick that one can walk for hours in shadow. The whole district is comparatively fruitful. The plains beyond are really savannahs, thickly overgrown with savannah grass and innumerable palms ; they appear to be inhabited only in the Todshié and Zio valleys, though a great number of animals (*e.g.*, a species of antelope, leopards, panthers, buffaloes, hyænas) are found there.

The whole territory is occupied by independent tribes, such as the Anlo, Aveno, Agbosome, whose boundaries are sharply defined. To the Agbosome belong also the Blokuso, Agavedsi, and Amutinu. Further east the tribal distinctions are not so well marked, chiefly because there are so many small tribes holding themselves independent. Among such the Aflahu and Lume may be mentioned. Herr Bürgi, however, distinguishes the whole territory between Ewe and Aveno (*e.g.*, Noeve, Dsodse, Keve), as Ave, a name which the country bears at several places. Around Tsevie the country is called Ewe. The inhabitants around the Togo lagoon, as far as Wo (Vo), belong to the Togo tribe, and among them are included the kingdoms of Little Popo, Agué, and Great Popo.

As regards Herr Bürgi's journey last March to Nodshie, the people west of the Zio were found to be quite accustomed to Europeans, whilst to the east the party aroused greater curiosity. Beyond Tsevie the landscape undergoes a complete change : an extensive plain stretches as far as Agu, which is sparsely inhabited and very slightly wooded. Game (Ganie) is, however, a large town in frequent intercourse with Adangbe. The Nodshie people are described as being a most interesting people—a small, sharply defined tribe, living in seven villages almost in a line, at about one hour's march between each other. These villages are named Alinu, Agbaladome, Adime, Tegbui, Gbedome, and Kplakpu. Dako and Ekli lie towards the east, between Agbaladome and Adime. The chief town is Agbaladome. Herr Bürgi returned to the coast by a more circuitous but better known route : in consequence of illness he was prevented from sending a detailed account of his journey, but this he has promised to do eventually.

Imperial British East Africa Company.—The London *Gazette* of the 7th September last publishes the text of the Royal Charter granted to the Imperial British East Africa Company. The *Times* of 8th September publishes an account by a well-informed correspondent of this new sphere of British interest, from which we abstract the following interesting paragraphs :—"The object of the company is, among other things, to undertake, under terms of the concession dated May 24, 1887, made by the late Sultan of Zanzibar to the British East African Association, 'the entire management and administration of those parts of the mainland and islands of the Zanzibar dominions on the East Coast of Africa appertaining to the territory lying between Wanga and Kipini, both in-

clusive, which are recognised in the Anglo-German Treaty of 1886 as reserved for the exclusive exercise of British influence, together with any further rights of a similar nature in East Africa, or elsewhere, which the company may hereafter acquire.' The company, moreover, aim at acquiring from other chiefs, besides the Sultan, either the possession of, or the power of administering, their territories. The Royal Charter has been conceded to Mr. William Mackinnon, as President, Lord Brassey, Vice-President, Sir Donald Stewart, Sir John Kirk, Mr. W. Burdett-Coutts, Mr. R. Palmer Harding, Sir T. Fowell Buxton, Mr. J. F. Hutton, Sir Arnold Kemball, Sir Lewis Pelly, Mr. George S. Mackenzie, Sir Francis de Winton, Mr. Alexander L. Bruce, and Mr. Robert Ryrie, who constitute the first Court of Directors. Besides the concession by the Sultan of the ten-mile-wide strip of coast-line, 150 miles in length, the company have made treaties for other concessions of territory with a host of chiefs in the interior. Everything has been done in the most open and regular manner. The charter recites the objects which the Company have in view—the promotion of commerce and the good government of the territories acquired—and recognises that the possession of the coast-line such as is defined, which includes the port of Mombasa, 'would be advantageous to the commercial and other interests of our subjects in the Indian Ocean, who may otherwise become compelled to reside and trade under the government and protection of alien Powers.' On these and other grounds, the Company is incorporated as the Imperial British East Africa Company. The first issue of capital—£250,000—has been privately subscribed by thirty-five gentlemen, who form the founders of this great undertaking.

"Except along its southern edge our knowledge of the extensive region which has thus been brought within British influence is exceedingly scanty. Until Mr. Thomson penetrated across it our information was mainly derived from native sources. Even now that the region has been entered by other European explorers and sportsmen, our knowledge is necessarily vague, and much remains to be done before the Imperial British East Africa Company can be in a position to estimate the productive and commercial capacities of their territory. Probably the finest harbour on the sea-coast, deep, accessible, landlocked, capable of holding twenty ironclads, is Mombasa—on the coast which has been conceded to the British company. Hitherto the unhealthy, humid, maritime zone, of an average breadth of 200 miles, has been one great obstacle to the development of the comparatively fertile and salubrious interior. The influence of Mohammedan traders on the coast, moreover, has been inimical to that of Europeans; to it is due the large development of the slave-trade in the interior. There have really been no regular trade-routes in Central Africa; only narrow native paths, mainly used by slave caravans, and always changing. These trade-routes avoided, as a rule, the most healthy regions, where the population was too robust and vigorous for the slavers to contend with it. The interior high lands are in many places peopled by a really fine race, shut out from the coast by Semitic influence.

"Among the native products of the districts adjoining the Zanzibar coast regions are indiarubber, of at least two species, copal, hides, grain, orchilla, oil-seeds, copra. The Somali country has great commercial capacity. Although the islands of Zanzibar and Pemba are cultivated in the rudest possible manner, they furnish a large proportion of the clove-supply of the world. Quite recently tobacco of the best quality has been grown by the German planters.

"There is one great advantage to start with which the coast of the British zone possesses over the coast generally. Beyond the central half, from a little south of Mombasa to Malindi, the deadly character of the maritime region is reported to be almost entirely absent. After 25 miles of low hills and undrain-

able depressions, the country rises by a very gradual slope to the elevated plateau of the interior. From what information we possess, it would seem that the atmosphere is dry and comparatively healthy ; rank vegetation is absent, perhaps because of the porous nature of the sandstone undersoil. No fair estimate of the rainfall exists. But that it is not very abundant is shown by the nature of the trees, ebony, teak, thorn, and other hard woods, with vast quantities of hepatic and fibre aloes ; yet the ground is stated to be covered with short, sweet pasturage of regular growth. The greater part of this country has been depopulated by the Masai ; though in the dense forest patches small village communities are found, with considerable plantations of Indian corn, millet, beans, and lentils, and with flocks of oxen, sheep, and goats. This was formerly essentially a cattle district, but the raids of the Masai have temporarily converted it into a wilderness or uninhabited prairie. Except in the rainy season the small streams or brooks are dry, but water in considerable quantities is found stored in natural tanks or circular holes in the sandstone ; it is reported that there is plenty for drinking purposes and even for railway uses, should a railway ever be made. Similar tanks on a larger scale could, it is believed, easily be made artificially. From Taro, about 60 miles from the coast, to the south-east base of Kilimanjaro are two long waterless stretches of 50 miles each.

"Readers of Mr. Thomson's *Masai Land* will remember his glowing description of the forests and glades of Taveta after his weary march from the Coast. Later visitors confirm this description, but the forests are at present dangerous on account of miasma. The forests are full of springs and deep deposits of alluvial soil which affect even the natives. The Taveta forest is 15 miles by 3, and when it is cleared the fertility of the soil will be almost inexhaustible. All travellers speak in glowing terms of the fertility of the plateau (2500 feet) to the west and south-west of Taveta, around Kilimanjaro ; not only are there abundantly native products, but anything will grow one chooses to plant. Germany has here 2000 square miles of the very best land. The natives are great bee-farmers, the district yielding about 100 tons of honey and wax annually.

"As to the southern portion of the Taveta plateau, very favourable reports are given of its agricultural possibilities. It has an altitude of 2500 feet, rising gradually for 100 miles towards the north-west. The plateau is about 50 miles wide. Though not particularly well watered, as is shown by the absence of large trees, it is covered with pasture. The region is reported to be to all appearance well adapted for wheat culture. It has the necessary elevation, a soil suited for the purpose, rain sufficient to mature two crops of fine grass annually. Still, the real capacity of the great southern plain, and an even more extensive one to the north, must be practically tested by those familiar with Indian modes of culture ; those who know the facts are confident of the result.

"The south Masai plain has a very large area available for cultivation. The climate is colder than the Taveta plain, the temperature ranging from 52° to 72° only rising to 80° in the hottest part of the day. Of course, it should be remembered that all these conclusions are based on very limited observations, and much yet remains to be done before a satisfactory knowledge of the country and of its capacities has been obtained. The country, so far as these high plains or plateaus are concerned, is stated to be 'one of the most salubrious in the tropics—probably in the world'—capable of becoming a permanent settlement of British colonists and a new centre of trade. This, it must be admitted, is a strong statement to make ; but it can be easily tested, and no doubt soon will be.

"There is, however, a far more extensive plateau to the north of this, possessing to a high degree all the essential conditions of soil and climate suited for wheat culture. Mr. Thomson, indeed, describes the climate as very similar to that of Europe. The plateau strikes away north-west to the Victoria Nyanza. It has an average height of from 3000 feet to 4000 feet, with a greater and more regular rainfall than the southern plain, but is not too wet for wheat. It is more wooded than the Masai plain, and has a population of robust and independent agricultural tribes, able to hold their own against the Masai.

"Ivory alone, of which no doubt a fair supply now exists, may soon be difficult to obtain, though the company will take stringent measures to prevent the diminution of the present supply. Besides wheat, the country is capable of producing tea, chocolate, coffee, vanilla, pepper, tobacco, opium, carob beans, cinchona, wines ; while among native products there are Indian corn, hides, rubber, cotton, copal gums, wax, honey, aloes, fibres, oil-seeds, orchilla. Manufactured goods of various kinds could be introduced and exchanged for these products at a very handsome profit, and yet with perfect satisfaction to the natives.

"One of the first tasks the Company will have to undertake will be to settle with the fierce Masai warriors and cattle-raiders. This may possibly be accomplished through their great high-priest, who has much influence. Whatever method the company may be compelled to adopt, the Masai must be induced to become peaceful citizens of the new State. At present they are the scourge of the whole region. They are perpetually carrying slaughter and devastation among their neighbours, stealing their cattle, and rendering anything like settled industry impossible. If the Company succeed in putting them down they will do a service to humanity and to Africa. The latest estimate affirms that the Masai do not number more than half a million, only about one-third of Mr. Thomson's estimate.

"As to the adaptability of the country to wheat—both in India and Australia we know that good crops of wheat are raised with a rainfall of very scanty proportions ; only in both regions, especially South Australia, the rainfall sometimes happens to be *nil*. In India, for example, a rainfall of from 8 to 45 inches yields profitable crops. There the great wheat-fields are from 600 to 1200 miles from the coast, while in East Africa they would not be more than 300 miles from the port of shipment. The crops in East Africa, moreover, would be ready for reaping and for shipment just in the intervals between the harvests of India, so that an almost constant supply could be sent to Europe, which, owing to its own decreasing supply, requires to import more and more from abroad. In India the wheat yield has increased in ten years from 2,000,000 cwt. to 21,000,000 cwt., valued at Rs. 80,000,000, and this mainly owing to the extension of the railway system. Thus it would seem from the *data* available, that British East Africa is even more favourably situated as a wheat-growing country than British India, and, with the best seeds and best methods of culture and storage, should ultimately take a high rank. Whatever may be the case with wheat, there can be little doubt as to the adaptability of East Africa for Indian corn, of which 32,000,000 cwt. is imported by Europe annually, though only 50,000 cwt. comes from India.

"Mr. George S. Mackenzie, who has had a long and varied experience of the Arab and Persian tribes in the Persian Gulf, has left for East Africa for the responsible duty of taking over the concession from the Sultan, and inaugurating this important work. He takes with him a well-selected staff of Englishmen, whose qualifications fit them for the work, and the operations of the Company will be commenced at once by the despatch of a well-appointed caravan to open

up the interior to European trade. Already one has been sent up the country, and with the energy, capital, and experience which direct the great enterprise, we may hope at no distant date to be able to measure results in proportion. And, while every Englishman will feel proud of the success of an undertaking so distinctly characteristic of British enterprise, not the least sentiment of national gratification will be that which arises from the hope we may now feel that we are within measurable distance of the end of the unholy slave-traffic of the dark region into which the light is now about to enter."

Notes from East Africa.—A correspondent in Zanzibar sends us (1st August 1888) the following items of information :—The German Wito Company, which started some two years ago with a small capital (about £25,000) in the Sultanate of Wito, which was placed under German protection, do not appear to have made any progress in the way of cultivation or trade. An agent of the company has settled on Lamu island (belonging to the Sultan of Zanzibar), and has built himself a house there, as also others at places along the coast; but the greater number of them are in ruins. On the other hand, Messrs. C. & G. Denhardt, who first explored the country, and who surveyed (1878) the river Tana as far as Massa, have done a great deal in the way of cultivation (especially of tobacco) in Wito; at Wange, in Manda Bay, they have cleared a large tract of country. Wange is one of the most healthy places in the district of the coast referred to; lying somewhat higher than the immediately surrounding country, and exposed to the sea-breezes, it enjoys a cooler climate; there are, moreover, no mosquitoes there.

At Ngao and Golbanti, the German and British Mission Stations on the Tana, they were in hopes of doing good work; but the country is most unsafe, in consequence of the frequent raids of the Masai and Somali warriors on the Galla and Wapakomo tribes established on the Tana. A few months ago the German Mission Station was burnt to the ground, during one of these raids, but the missionaries happily escaped to Golbanti, afterwards returning to Ngao.

The expedition under Count Teleki is expected to return down the Juba River; if they succeed, it will be a great feat, as they will have to pass through some very hostile districts.

AMERICA.

Washington Territory.—The report for last year on the resources of Washington Territory has lately been issued by the British Vice-Consul at Port Townsend, and contains a large amount of valuable information, from which we extract the following :—The forests consist, for the most part, of red and yellow pine, known to the trade as Oregon pine, and so vast is the area occupied by these trees in the neighbourhood of the Cascade Mountains alone, that the supply is expected to continue for many years to make the output of timber, what it now is, the largest and most important export of the Territory. The capacity of the saw-mills employed for the year in this industry has been calculated at 645,440,000 superficial feet. American vessels carried coastwise 370 cargoes of lumber, amounting to 257,689,438 feet, and valued at £686,295. The rivers, especially the Columbia, have valuable salmon fisheries, and 6000 persons and £400,000 are annually required to conduct this industry on the Columbia alone. The crops consist principally of wheat, oats, beet, potatoes, carrots, and turnips, all of which are raised in enormous quantities, although all do not grow equally well in every part of the territory; besides, fair returns are got from the cultivation of hops, tobacco, sweet potatoes, melons, plums, apricots,

peaches, and other fruits. Stock-raising is engaged in with satisfactory results. The chief minerals are gold, silver, copper, cinnabar, lead, marble, limestone, sandstone, and coal; but want of transport facilities have hitherto checked the development of the mining industry, which appears to have a promising future. The coal deposits are, apparently, of considerable value and importance, generally consisting of the lignite and semi-bituminous varieties. On the western borders, all the coal-fields are within forty miles of tide-water, and as the cost of mining and transport to the sea is only from 2s. to 3s. 6d. per ton, a large export trade may be confidently looked for in the future; the mines, indeed, have already yielded 2,461,108 tons, with an increasing monthly output, principally for the California and Oregon markets. The eastern portion of the territory appears to be richer in gold and silver than any other part; but not much has been done to prove this surmise, although late experiments go to establish the existence of rich mines in that district. Iron ore is present in seemingly inexhaustible quantities, but here again want of transport has, as yet, proved a bar to successful working. A trade with Great Britain is confidently looked forward to, and has already received some encouragement. It is expected that our ports will prove valuable marts for pig-iron, cement, fire-clay, fire-brick, salt, hop cloth, and grain bags. The railway extension is progressing rapidly, with the hope that imports from Great Britain, principally in the shape of English rails in exchange for which grain cargoes are offered, may be directed mainly, if not altogether, to Puget Sound, which may be looked upon as the future port of the territory.

GENERAL.

Fog Bows.—Professor Tait, in a recent paper on Fog Bows (see *Proc. R.S.E.*, No. 126), remarked that one of the constituents of the *double* fog-bow described in some of Mr. Omond's recent observations (at the Observatory on Ben Nevis) is obviously the ordinary primary rainbow, diminished in consequence of the very small size of the water-drops. But the other, having the same radius, *but with its colours in the opposite order*, appears to be due to ice-crystals in the fog. This is quite consistent with the records of temperatures. Just as small drops of water may remain unfrozen in air below 0° C., small ice-crystals may remain unmelted at temperatures above that point.

On the Colour of the Skin of Men and Animals in India.—Professor Wallace, of Edinburgh University, contributes to the *Proceedings of the Royal Society of Edinburgh* (No. 126), the following abstract of his paper on the above subject:—Indian cattle have, with few exceptions, jet black skins. The hair is frequently white, grey, brown, or black, but only in rare cases are the skins white. The animals having white skins are weakly, if not unhealthy, are liable to blister with the sun, and contract after a time a form of leprosy. This opens up and widens the scope of a most interesting question on the relation of colour to climate, which—I have it on the very highest authority, that of Professor Huxley—is by no means at present understood. The field of investigation as regards India is a large one; it embraces the human races, and the breeds of cattle, sheep, pigs, buffaloes, and horses. The skins of all, as a rule, are black or dark-coloured; the few white exceptions I have noticed particularly in buffaloes and cattle, and in one case of a goat, are, as stated, delicate. The white or grey hair so prevalent in cattle extends to the Arab horse, and would appear to be, when associated with the black skin, peculiarly well adapted to resist the extreme heat of a tropical sun. It has always been a marvel that the white

skin, which on account of its colour does not absorb heat so quickly as a black skin, should not prevail in the human species within the tropics ; and it becomes even more wonderful, now when it begins to dawn upon us, that the skins of the lower animals follow the same great law of nature, whatever that law may be. It would seem at first sight that the black skin should rather be a disadvantage than otherwise ; but in the reality it is not so. The black colour of the skin causes it to absorb more heat than a white skin, but while it is doing so, at the same time, and for the same reason, it is giving off more heat—its absorbing and also its radiating power being greater. Therefore, when the sun's rays impinge upon the skin, the heat is rapidly absorbed ; but, as the rate of absorption of heat is greater than the rate of radiation, unless the temperature of the skin were lowered by some other influence, the whole surface of the body would become extremely hot. To complete the explanation we must here take into consideration what is known of black-skinned men. Any one who has been in India can see that natives, although they drink water freely, do not appear to perspire so copiously as Europeans, but this is simply because more of the perspiration comes from them in the form of vapour, and less is seen to stand like dewdrops on the surface of the skin. In the evaporation of the moisture exuding from the skin we have a demand for heat far greater than an ordinary observer might imagine ; and by it can be disposed of all the surplus heat which the black skin absorbs over and above what it gives off by radiation. It is a fact which few realise, that the amount of water is small indeed which, by being evaporated, could transform into its latent condition all the heat derived from the warming influences of the sun in the hottest climates.

MISCELLANEOUS.

Lieutenant Vangèle, with a small force, peacefully re-occupied the **Stanley Falls Station** last June on behalf of the Congo Independent State.

An important discovery of coal has lately been made in the **Crimea**. The quality closely approximates to that of Scotch coal, and it is expected to prove useful for naval and other purposes.

The Revenue of Cyprus appears to be steadily decreasing. The maximum income, since the island became a British possession, was in the years 1883-84, when it amounted to £194,000. For the years 1887-88 the sum realised was only £145,443, of which £93,000 comes under the head of "tribute."

The chief station of the **German New Guinea Company** in the Bismarck Archipelago has been changed from the island of Mioko to the island of Keronwara, south of New Lauenburg ; it was placed under the command of Count Pfeil, the African explorer, reports of whose death have more recently been received.

We learn with great regret of the death of **Major Barttelot**, Mr. Stanley's lieutenant, who left the camp at Yambuya rapids with a large caravan last June to follow in the footsteps of Stanley. The reports state that he was assassinated. **Mr. Jamieson**, the second in command, died of fever a month after assuming the control.

The Paris Geographical Society, who this year celebrated the centenary of the death of **Lapérouse**, have issued in one volume (*Bulletin*, etc., *Septième Série*, *Tome* ix.) an account of his famous voyage, illustrated by a special track-chart. A bibliography of works relating to Lapérouse or to his expedition, brought up to date, is given by M. Gabriel Marcel.

The *Mouvement Géographique* of 26th August announces the departure from Bordeaux on the 20th August of Captain Trivier, of the French Navy, and M. Weissemburger, who propose to cross the continent of **Africa** from West to East, their route being Loango, Stanley Pool, Bangala, Stanley Falls, Nyangwé, Manyéma, the Lukunga, M'pala, Karéma, Tabora, Bagamayo, Zanzibar.

The expedition under Lieutenant Kund will (*Deutsche Kolonialzeitung*, 18th August 1888) await the arrival of Lieutenant Tappenbeck in Cameroons before starting on a new expedition into **Batangaland**, where it is proposed to erect on the banks of the river Sannaga a scientific station. The German authorities have arrested fifteen of the Bakoko people who fired on the expedition on its return journey.

The Fishery Board for Scotland, in continuance of the chemical and physical investigations of the seas bordering Scotland, have despatched H.M.S. *Jackal*, under the direction of Dr. John Gibson of Edinburgh University, for a six weeks' cruise in the northern part of the **North Sea** and in the **Baltic**. The Board hopes to be able to combine with similar organisations on the Continent to carry on systematic observations at sea.

The efforts being made in Germany, chiefly at the untiring instigation of Dr. Neumayer, for the despatch of an expedition to the **Antarctic Regions** appear to be promising. According to *Petermann's Mitteilungen* (viii. 1888), Mr. H. Villard, a well-known German American, has offered a considerable sum of money in support of an expedition; and it is hoped that the Imperial Government will not withhold its support.

Major-General Prjevalsky started in the early part of September on his fifth journey of exploration in Tibet, with the object of penetrating, if possible, into Lhassa, the capital. The General, with his officers and Cossacks, will this time take advantage of the Central Asian Railway as far as Samarquand, whence they will proceed to Semiretchinsk, and so to the Tibetan table-lands. General Prjevalsky will, it is thought, on this occassion have the best chance ever afforded him of entering the forbidden residence of the Dalai Lama.—*Nature*, *Sept.* 6, 1888.

NEW BOOKS.

The Building of the British Isles: A Study in Geographical Evolution. By A. J. Jukes Brown, B.A., F.G.S. London: George Bell & Sons, 1888. *Price* 7*s.* 6*d.*

In this compact little volume Mr. Jukes Browne has set himself the task of discussing a problem whose interest is only equalled by its difficulty. He endeavours to work out the past geographies of this part of the European area, and gives a series of maps showing, so far as our present knowledge goes, the general distribution of sea and land at each great stage in our geological history. The farther back we go the greater is the difficulty in tracing the ancient sea-margins and physical features of long-lost continents, and here Mr. Jukes Browne has avoided the error other writers on the same subject have committed, as he has said but little and hazarded no maps of the British area in the remote Archæan and Cambrian periods. The maps, which number no less than fifteen, show the supposed outlines of the sea and land at intervals of time more or less widely

separated and still less sharply defined, beginning with the Ordovician, or, as it is generally called in Scotland, the Lower Silurian period. It is very doubtful if the outlines of such ancient lands can now be ascertained with any degree of accuracy; but, when we come down the geological record and approach the more recent stages in the earth's story, the cartography increases in trustworthiness. From the Carboniferous downwards to the Pleistocene or Glacial epoch, the British area has undergone many notable geographical transformations, and these are discussed in the interesting chapters that make up the bulk of the volume. During the Ice Age great oscillations of the sea and land took place. At one time the British Isles were reduced by subsidence to a group of rocky islets far out in the Atlantic, and again the sea retired till our silver streak was severed, and we were joined by a broad and well-watered plain to the neighbouring tracts of Central Europe and Scandinavia. In the last chapter the author discusses the problem of the supposed permanence of continents and oceans. He is "convinced that the truth is neither with those who assert the complete permanence of oceans and continents, nor with those who teach the frequent conversion of one into the other."

The book is well got up, and is altogether a most interesting and valuable contribution to a department of geography whose difficulty renders it the more attractive alike to the physical geographer and the geologist.

Between the Ochils and the Forth. By David Beveridge. Pp. xiv, 336. Edinburgh and London: William Blackwood and Sons, 1888. *Price* 6*s.*

In the melancholy future forecast as long ago as 1819 by Shelley, "when the piers of Waterloo Bridge shall become the nuclei of islets of reeds and osiers, and cast the jagged shadows of their broken arches on the solitary stream;" and when Macaulay's New Zealander shall have satisfied his soul with gazing on the prospect, it is not perhaps too much to expect that he may come north to see how it stands with the Forth Bridge. Whether or not it have by that time shared the fate of the London structures, it is not unlikely the tourist from the far south may be tempted by the fair country opposite him to cross and visit the region between the Ochils and the Forth. If so, he or any earlier tourist could hardly wish a better *vade mecum* than Mr. Beveridge's "description, topographical and historical, of the country between Stirling Bridge and Aberdour" and besouth the Ochils. It is an unusually excellent and entertaining work, which is at once an ample guide-book, serving the purpose of cyclists as well as of mere leisurely travellers; and a copious history of antiquities, local families, and famous natives. It has an interesting disquisition prefixed on the ancient inhabitants, dolichocephalic and other, in which Dr. Skene, Professor Rhys, and the newest-light anthropologists have been had regard to. Little is omitted which one could expect to have. The book may be heartily recommended; though the old inhabitants are perhaps too confidently identified with the Basques, and the Basques with the Turanians; though the Philistine would object that in describing the Rumbling Bridge ravine, "terrific" (twice), "tremendous," "fearful," "horrible," and "sublime" are perhaps too superlative; though the Whigamore from Ayrshire or the other "Covenanting shires" would hardly admit that Fife and Kinross were *the* strongholds of Presbytery; and though probably geologists would hesitate to agree with Mr. Beveridge in regard to the rocking-stone on the drove-road above Dron, that "the only reasonable conclusion that can be come to is that they were placed there in remote ages in expiation of some crime or fulfilment of some vow." There is a good map of the district by Bartholomew, and a full index.

India in 1887. As seen by Robert Wallace, Professor of Agriculture and Rural Economy in the University of Edinburgh. With Plates and other Illustrations. Edinburgh: Oliver and Boyd, 1888. Pp. xxiv, 363.

Nearly a century has passed since, in 1790, the action of Sir John Sinclair led to the first inquiry into the state of British agriculture. The next movement of the kind was, strange to say, made by an Englishman in India, where William Carey the missionary, and then indigo-planter, prepared his marvellous monograph on the "State of Agriculture in the District of Dinajpoor." In 1820 he founded in Calcutta the Agricultural and Horticultural Society of India, which was the model for the Royal Agricultural Society of England, eighteen years afterwards. Carey's relation to forestry was as original as it was to agriculture, but it was not till 1846 that the rapid disappearance of the teak forests of Malabar led the Government of India to adopt a system of conservancy to supply the Bombay dockyard.

The next agricultural reformer in India after William Carey—who had been supported by the Marquis of Hastings and his wife—was Lord Mayo, whose Irish experience led him, when Viceroy, to establish a Revenue and Agricultural Department. Unhappily that Department has not yet justified its existence. The Government of India derives half its net revenue from the land, and renews the leases of at least two-thirds of the whole country, after a survey of the peasants' and zemindars' holdings. No Government in the world has so keen a financial and social interest in agricultural reform as that of India. Its political existence as well as the material happiness of the people depends more on the fairness of its land assessments than on any other cause. But the agricultural experiments of India have, in spite of famines and the demands of the export trade, been too constantly a series of expensive mistakes.

Professor Wallace has, for the first time since Carey's forgotten treatise, pointed out the way to agricultural reform by showing (1) that European systems are unsuitable to the conditions of India; and (2) that "the more nearly nature is imitated, or the best native practices followed, the more successful will be the final results." These two propositions he illustrates in detail, with all the skill of an expert and the enthusiasm of a reformer. No visitor to India has shown such energy as he has done during four months of the greatest heat and rain in the plains of India, in researches extremely detailed into cattle-breeding, produce, and diseases; buffaloes, horses, and mules, sheep, goats, and pigs; soils, native implements, irrigation, rotation and mixed crops, grasses and grass land, forestry, chemistry, veterinary science, and a department of agriculture. The whole forms a truly original book, with about a hundred illustrations, of which three are admirable maps of India showing the chief characteristics of land surface, the orographical features, and the political divisions. The book is a challenge to the Government of India, which it should do much to enlighten.

Orient and Occident: A Journey East from Lahore to Liverpool. By Major-General R. C. W Reveley Mitford. With Illustrations from Sketches by the Author. London: W. H. Allen and Co., 1888. Pp. 359.

This volume consists of the condensed notes of a traveller of average intelligence, without scientific or other special tastes, a gentleman and a clear and accurate writer. We happen to have passed over the whole of the route described, with the exception of the Pacific Ocean, and can recommend the book as suggestive to intending tourists, and as pleasant reading for those who would look back on their experience. The illustrations are numerous, and the route-map is on Mercator's projection—of these, that is all that can be said.

Eighteen Hundred Miles on a Burmese Tat through Burmah, Siam, and the Eastern Shan States. By an ordinary British Subaltern, Lieutenant G. J. Younghusband, Queen's Own Corps of Guides. Pp. 162. *Price* 5*s.* London : W. H. Allen and Co.

This little book is amusing and humorous from the first page to the last, and contains, as if by accident, and partly under protest, a little information besides. The character of the people, and of the *régime* under which they live, the system and management of caravan-travelling, and the various adventures and troubles that befell the traveller, are all incidentally illustrated. The total absence of large game along the route—the author was travelling partly in search of sport—is curious. Starting from Moulmein, his route lay up the Salwín River, by Maingloongye to Chieng-Mai (or, as he writes it, Burmese fashion, Zimmé), and Kiang-Tung, whence returning he struck the Me-nam, near Muang-Nan, and descended the river thence to Bangkok. We cannot but regret, as geographers, that the writer did not see fit to go more into topographical detail, especially as to the first half of the journey, in view of recent discussions of railway and other trade routes, though the line he took was almost entirely different from that prospected by Mr. Holt Hallett. He asserts that the caravans from China bring very little trade, chiefly indigo, tea, and shoes, and that this little remains in the Shan country, the mules going on unloaded to Moulmein, whence they bring up cheap cotton goods and "odds and ends of trumpery." But if this is so, how are these goods paid for? The most valuable product of the Shan States seems to be the so-called "Burmese" ponies, the importance of which has been noticed by previous travellers. Mr. Younghusband's remarks on the political condition and feeling in these States has a practical interest for us at present. In Kiang-Tung alone, on his entire route, did he experience any unfriendly feeling. This State is the chief of those which were under the nominal, but latterly more or less repudiated, supremacy of Burma. The author considers that we should do well to confine ourselves to the great natural barrier of the Salwín valley as our Eastern frontier, regarding probably as unimportant the existing hostility of some of the Shans to the west of this river. His suggestion of a speedy definite understanding on boundary questions with China and Siam has much to recommend it; but when he complains that the great Siamese-Laos State of Chieng-Mai has been encroaching on the Shan States to the north, it must be remembered that Kiang-Tsin, the northern limit of this extension, was conquered by Siam 100 years ago, and has long been reckoned as belonging, through Chieng-Mai, to Siam. Again, how far Kiang-Tung, if left to itself as he proposes, could hold its own, is very doubtful. Kiang-Hung, which it lately conquered, has already appealed to China, and would probably place itself under that Power. The writer speaks of the English and French territories (*i.e.* these Burmese Shans on the one part, and Tongking on the other) as already conterminous, a statement which, without going further into the matter here, can only be taken with very large qualifications. A less crude and primitive "Map" might surely have been provided.

Sur le Haut-Congo. By Camille Coquilhat. Brussels: Lebègue et Cie., 1888; viii. and 533 pp., with numerous Illustrations and 5 Maps.

The mystery that surrounds the fate or present position of the great finder of discoverers, and the melancholy news of the death of Major Barttelot, who was to be rescuer of the rescuers, lead all who have ears to hear to turn with interest to a book on the Upper Congo by a Belgian officer of the Free State. The

persons and places named in Barttelot's last report—Tippu Tib, Kerckhoven, Vangèle, Deane, Liebrechts; Bangala, Stanley Falls, Aruwimi—are precisely among those most prominent throughout Captain Coquilhat's book, and there are process-portraits, mostly from photographs, of the men and places whose names are at present in everybody's mouth.

Captain Coquilhat, then Lieutenant in the Belgian army, volunteered for service on the Congo, and left Belgium for Africa in August 1882. He had an important share in establishing the station at the Equator, and was the founder and chief of the Bangala Station further up the Congo, till his return to Europe in December 1886. The first part (pp. 1-134) of his book deals with his experiences ere he reached his own remote post, and his apprenticeship to African ways; the second (183-358) deals minutely with his official sojourn amongst the Bangala (Ba-Ngala); the third (385-415) gives a full and particular account of the Station of Stanley Falls, from the discovery of the place by Stanley down to the fall of the Station and the rescue of the miserable survivors by M. Coquilhat, with additions carrying on the history to the arrangement made between Stanley and Tippu in 1887; and a concluding division (469-482) gives a hopeful but not optimistic view of the prospects of the Congo country in respect of commerce and civilisation.

Of active geographical exploration of new territory, there is not much in the work; but the course of the river and the country on its banks are very vividly described. The manners and customs of various tribes, but especially Bangala, are given with very special fulness—their houses, manufactures, modes of warfare, cookery, dances. Their religious ideas, if such they can be called, were judiciously extracted from them by the author; and he gives interesting but painful accounts of the methods of conducting human sacrifice, and the manner in which the various parts of the human body are cooked for their occasional cannibal feasts. An almost too complete view is obtained of everyday life on the Congo, of the author's comings and goings, his and his friends' interminable difficulties with neighbouring chiefs, chiefs' cousins, chiefs' nephews, or other relatives. For a general reader there is almost too much detail drawn from 'Kokia's' diary; and, with an occasional tone of apology, the author seems at times to magnify his office (as when he prints *in extenso* in separate supplements short notes from his official colleagues and superiors recognising his services). But the book is one of great interest to anybody wishing seriously to study life on the Congo. There is much about the personal history, character, and conduct (not very reassuring at the present moment) of Tippu Tib. Separate supplements give the population at Bangala, the crops and vegetables that may be made to grow there, and the principal articles of exchange on the Congo (so far as we can see, the trading in M. Coquilhat's time was confined to buying food and necessaries from the natives for European produce). The printing and get-up are good, and the illustrations interesting.

Explorations and Adventures in New Guinea. By Captain JOHN STRACHAN. *Price* 12*s*. Pp. xv. and 300. London: Sampson Low and Co.

The "adventures" recorded in this volume—the marches through unknown jungles, and intercourse, hostile or friendly, with the natives, are stirring enough; the "exploration" is confined chiefly to a deltaic tract enclosed by two arms of a river, one of which, known as the Mai-Kassa or Baxter, was first visited, in 1875, by Messrs. Macfarlane and Stone, who ascended it apparently to a greater distance than was reached by Captain Strachan. It would appear only fair therefore to retain, for the stream above the point of bifurcation,

the name first given by the former explorers, instead of adopting, with Captain Strachan, the name of "Prince Leopold," which he has given to the western branch. There is great reason for the view suggested by Captain Strachan, that this river and its affluents are closely connected with, if not immediately derived from, the great stream of the Fly; but this was already indicated in the map which accompanies Mr. Coutts Trotter's paper in the *R. G. S. Proceedings*, 1884. Captain Strachan's hypothesis that the Fly is connected with the Utanata, which debouches some 400 miles to the westward, must remain for the present mere conjecture, rendered, we think, improbable by the position of the Charles Louis range, and by the character of the deposits in this stream. His "dream" that such a river might afford "a water-way to China" is a dream altogether passing our power of interpretation.

We note that Captain Strachan, like Mr. Stone, remarked the presence of rocks and "ironstone," the traces, we conclude, of an earlier country, since covered by the mass of alluvium, and perhaps coming again into prominence by the eroding action of the river courses. Captain Strachan, however, draws a much more highly-coloured picture of the agricultural capabilities of the country than his predecessors; and even if the soil be all that he describes it to be, many other conditions would need to combine to make it economically available.

The other district visited by Captain Strachan is the deep gulf known as MacCluer Inlet, which he pronounces, on what seems to us insufficient observation, to be really a strait, cutting off the north-west portion of New Guinea, known as Berau, from the mainland. He accordingly styles this in his map "Berau Island," by which name, indeed, he says it is known. But in the Dutch maps it is styled Tanah (land or country of) Berau. The almost entire absence, in his narrative, of measurements of distances or positions, obviously detracts heavily from its geographical value. He tells us that he sailed up the gulf to within 3 miles of the opposite side of New Guinea, and that the passage continues all the way through. The Dutch surveys of MacCluer Inlet—and their surveys are perhaps fuller than Captain Strachan supposes—do not countenance this view. Dr. A. B. Meyer, too, in 1873, starting from near the Wapari River in Geelvink Bay, crossed the neck of land between the two seas, finding it 1250 feet high, and, coming on the Jakati (or ? Jeschke) River, followed it down to its mouth at the north-east extremity of MacCluer Inlet. Before returning he crossed to the south-east corner of the Inlet, but found there no trace of Captain Strachan's passage. Yet it is here, if anywhere, that the outlet is to be found, and a passage of the kind was in fact reported some time ago to exist, by the Dutch missionary at Wandessi, on the opposite coast, a view not rejected by Mr. Robidé van der Aa. It is strange, however, that if the passage exists it should not be commonly known and used by Ceramese and other traders, and it is at all events premature to represent it on the map. The hypothesis to which Captain Strachan alludes, of a water-way from Arguni Bay on the south coast, across the Onin district, into MacCluer Inlet, has always seemed to us far from improbable.

We shall always be ready to make generous allowance for the conduct of an explorer in difficult or critical positions, but what is to be said for a traveller who, by his own account, fires freely into "suspicious" canoes, not merely in a river where they cannot be avoided, but in open water; who takes prisoner a number of natives on suspicion, carrying them about in a boat alongside, and proposed to put them to death when, owing to an accident, he expected to require the boat; and who breaks both Dutch and English laws respecting the sale of arms and ammunition to the natives, the purchase of land, etc.? The violent abuse he lavishes on the Special Commissioner, the representative of law

and order, when read in the light of these passages, certainly loses somewhat of its force!

Lectures on Geography, delivered before the University of Cambridge during the Lent Term, 1888, by Lieut.-Gen. R. STRACHEY, R.E., C.S.I. London: Macmillan and Co., 1888. Pp. 211. *Price* 4*s.* 6*d.*

These Lectures were given in order to indicate the character and scope of Modern Geography, as a preliminary to the election of a Reader in Geography at Cambridge. General Strachey confined his work to a statement of the substance of geographical instruction, leaving to the teacher who was to succeed him the purely professional question of how it should be imparted. The lecturer summarises geographical science rather than geography, but he treats the subject in a manner at once authoritative, clear, and interesting.

Lecture I., after some general remarks on the higher teaching of geography, sketches the early history of discovery, and enforces the importance of using maps and pictorial methods. Lecture II. is a sequel, reviewing the period of the long exploring voyages that opened up the distant continents, and passing to that of the wide scientific generalisations which resulted from improved instruments and progress in the collateral sciences. The latest conclusions as to the form and motions of the Earth, terrestrial magnetism, and geology as related to geography, are described. Lecture III. deals briefly with the physical geography of the earth, the distribution and elevation of the land, the depth and circulation of the ocean, the atmosphere and its various permanent and periodical phenomena. Lecture IV. rises to the consideration of vegetable and animal life from an extreme evolutionist standpoint, culminating in a short and rather indefinite discussion of the place of man, and his physical and intellectual dependence on geographical surroundings. The great departments of political, historical, and economical geography, which should have a place along with physical geography in University teaching, are practically unnoticed. It seems a mistake to omit the names of the originators of new theories, which are mentioned in the same manner as if they were fully established truths. Reference might also have been made to the source of the recent calculations which are quoted.

From an authority like the President of the Royal Geographical Society, writing with the view of convincing an ancient University of the claims to recognition presented by one of the youngest aspirants to the name of a science, we might expect at the outset a formal definition, but in this we are disappointed. A definition of geography would certainly be difficult to frame, but the statement that it is unnecessary because the term "Mathematics," with no precise significance, is clearly understood, by no means satisfies us. A great, if not the first, difficulty in the way of adopting geography as a University subject lies in the uncertainty of its range and the want of precise limitations. In fact some definition is needed were it only to prevent new Professors of Geography from poaching on the domains of older established chairs. The four lectures show very fully into how many sciences geography penetrates, but fail to mark any boundary between geography proper and the geographical aspect of those sciences. Had the purpose of the lectures been to prove how distinct and separable geography is, they would, we believe, prove more useful in the present state of British University teaching. Yet to the school-teacher and the general student this book will open many doors of thought, and enlarge the contracted scope too often assigned to the science of the Earth. Great things will be expected of the permanent lecturer who has to follow up the suggestions of these lectures in systematic courses, and much profit alike to learning and to geography may be confidently looked for.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

NOTES ON THE DUTCH EAST INDIES, 1888.

By Emil Metzger,

Hon. Corr. Mem. Royal Scottish Geographical Society.

III.—The Natives and the Planters.

It is often said that at the present time the tendency of things in the Dutch East Indies is in the wrong direction, and that ruin is imminent; some go still further, and give utterance to the opinion that the Dutch Government has become so enfeebled, that ere long they will be incapable of maintaining their colours on the islands of the Malayan Archipelago.

I do not think that these views are in any respect justified; to my mind there is a great difference between a concatenation of misfortunes such as have recently come upon the Dutch Indies and a real deterioration of national power, though, of course, to a superficial inquiry the consequences of both would appear to be very much the same. But surely the circumstance that the Dutch Indies have been able to weather all the disasters that have overtaken them of late is precisely the thing which proves that they do possess a fund of vitality and sterling power which cannot well be ignored, or indeed, too highly estimated. Though the expenses of the Acheen war have absorbed more than three hundred millions of guilders,[1] though the eruption of Krakatoa caused very serious damage, and ruined part of the residency of Bantam, though some years ago a murrain visited Java and diseases ravaged the crops of many of the residencies, yet the public revenue has been sufficient to cover all the extra expenses, to build railways, to open new lines of

[1] The total expenses cannot be made out exactly, since for the last few years they have not been returned separately, but have gone into the ordinary budget.

telegraphs; and to do all this, and more, without incurring debts to a greater amount than a fraction of the revenue of a single year.[1] That it has been possible to bear the strain entailed by all these extraordinary items of expenditure, is, as I have said, a convincing proof of the efficiency of the colony, and shows that its financial power is not exhausted, and that the empire of the Dutch is not so weak as is sometimes believed; but that it should be compelled to put its strength to such an undesirable test is a thing greatly to be regretted, and if it be continued it will inevitably lead to very serious consequences; indeed, some people believe that these have already begun to manifest themselves in the country. The manner in which the revenues have been forced up, especially considering the bad years that have of late been experienced in the plantations, is to be decidedly condemned alike by all the considerations of a sound economic policy as by the precepts of an enlightened humanity; and if those who hold the responsibilities of power in their hands are not anxious or willing to effect the improvements that are so urgently needed, the hen that once laid the golden eggs, and if nursed whilst ill would lay them again, will die, or perhaps events may ensue which will prove to be fraught with still graver consequences. It is not the evils which they could not prevent, but their short-sighted economy for which the authorities are to be blamed; it would have been better had they been willing to incur debts, even to a considerable amount and at a considerable sacrifice, and at the proper time to have spent, if needful, large sums of money, in order to improve the condition of the natives by diminishing the taxes, and by freeing them from the *corvées* in the plantations, where they are not sufficiently remunerative, instead of straining every nerve to balance the budget at any price. The evil consequences of the system should properly come upon those who, instead of procuring relief, which would have been both human and politic, have strained the law to extort the uttermost farthing from the natives; possibly they deemed it was their duty to do so, for they were not perhaps clear-sighted enough to foresee the mischiefs that have ensued; yet, properly speaking, they have only acted in accordance with the old adage, *après nous le deluge.*

The Netherlands are only a small country in the polity of nations, but the Dutch are proud of their history, and it would call up the blush of indignation to the cheek of every gallant Netherlander merely to suggest to him that the descendants were not capable of maintaining what their ancestors had won. Nevertheless many of them seem to be strangely blind to the sufferings of the natives and the hardness of their lot, and, moreover, seem to be unconscious that the policy followed of late must lead to utter ruin.

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[1] The budget amounts to about 11 to 12 millions £ annually. For 1888 it was:—

Revenue.		*Expenditure.*	
In the Netherlands,	31,286,875 fl.	In the Netherlands,	23,992,879 fl.
In the Indies, .	104,448,684 ,,	In the Indies, .	117,292,481 ,,
	135,735,560 fl.		141,285,360 fl.

The Dutch East Indies participated for 45 million fl. in the loan of 1883; of that sum 25·4 million fl. are in cash.

Perhaps they comfort themselves with the thought that at any rate the worst European Government is better than the best of a native ruler. This is very true if the matter is looked at from the European point of view; but it must not be forgotten that other races may regard the question from quite another point of view, and that a people can bear even a very heavy burden, provided it be laid on them in a way consonant with their own economic customs and habits, and ways of living, but that the lightest burden becomes insupportable if it chafes and pinches, and he upon whom it is imposed is bullied and worried. I suppose that in England a fox even would complain bitterly if he were to be shot instead of being run down and done to death by the hounds!

The Native Agriculturists.—The natives of Java are beyond question able to endure high taxation, and they do not resent it if only it presses equally on their shoulders and is assessed in a manner to which they are not unaccustomed. And such is the case at present: the imposts are both heavy and vexatious; in the first place, the natives were, in part at least, able to understand that better days were beginning to dawn upon them, but now it has darkened again, and fresh exactions are added to those which already existed, though, it is true, less vexatious than what they had been accustomed to half a century ago.

(Since the data for the Dutch East Indian Possessions other than Java and Madura are very incomplete and insufficient, I must confine myself, as far as figures are concerned, to the inhabitants of Java, and afterwards add a few words to show how far the conclusions arrived at can be justly made to bear a more general or extended application.)

Of 21,467,445 natives living in Java on Dec. 31, 1885,[1] there were 4,486,258 engaged in various occupations, of whom 2,966,772 were husbandmen. Among the rest may be mentioned 15,262 chiefs in the service of, and paid by, the Government; 316,143 chiefs of village communities, etc., not paid by the Government; 324,885 merchants, pedlars, etc.; and 292,570 artisans and handicraftsmen, etc. Thus the bulk of the population is made up of agriculturists; and I will therefore, in the first place, examine their style of living.[2] If a husbandman be wealthy, his wealth generally consists in buffaloes, which very often become a source of additional riches to him, since his poorer neighbours come to hire from him as many as they want and can afford to pay for, to draw their ploughs, for which service they generally have to pay dearly—very often a considerable proportion of the produce of their fields. A native who possesses a large extent of ground requiring manual labour, can only make sufficient profits from it by letting it at a high rent to other people; field-work is not very profitable unless a man can do it himself, assisted by his family, since it is comparatively expensive to pay for hired help. It may be mentioned at the outset that "division of labour" has not yet advanced to the same point in the Dutch East Indies that it has in Western countries, and is almost unknown to the common

[1] The number given for 31st Dec. 1886 is 21,716,177.

[2] In what follows I am referring only to the common man, not, of course, to the "upper ten."

agriculturist of Java. He builds his dwelling himself, he goes into the forest to gather the materials for it, or to collect fire-wood, which he sells in the market if he is in want of a little ready cash. Near his house there are generally a few fruit-trees and a small kitchen-garden, the produce of which his wife takes to the bazaar; some chickens and ducks or geese are kept for the same purpose; in a word, he has more than one string to his bow whereby he can get a little ready money whenever he needs it, as long as his services are not required by his master. Draught-cattle he is often, as I have said before, obliged to hire. In some parts of the island he owns the better part of the arable land he cultivates (viz., the irrigated rice-fields, *sawas*) in individual possession, in other parts the *sawas* are the property of the village community, and are distributed among the villagers for a certain period. Though the latter system is of ancient date, and its origin much older than the Dutch rule, the Colonial Government have often shown a preference for it; where it prevails it is possible to lay heavier burdens on the natives, since a community cannot so easily escape the performance of the duties demanded, whereas a single man might be worried to such an extent as to desert his property and run away. The whole system of the government is based on the theory that the Sovereign is owner of the ground and the native has only the temporary use of it, for which he has to pay part of the returns (generally one-fifth) to the owner, and indemnify him by *corvées*; as we shall see later on, the incidence of most of the burdens falls on the shoulders of those who own *sawas* (irrigated rice-fields), which, as I have said, yield a much greater produce than any other fields the natives are allowed to clear and cultivate for their own use.

The native style of living is plain and inexpensive. A house, the construction of which is very simple, may be valued at 10 fl. (but if a European were to build it, and have to pay for the materials, it would be much more expensive). His children he is not obliged to send to school if he does not care to do so, and at a very early age they begin to assist him in his labours; youngsters at six or seven years of age tend the buffaloes, and drive them to and from their pasture-grounds. Light and firing he does not require to buy; before petroleum became almost a necessary, the cocoa-tree, growing on his own patch of ground, furnished him with what oil he required for frying his fish or nourishing his lamp. Before the white men poured into the country the products of their manufactories. the native was generally clad in home-spun stuffs; and the assistance of "dukuns" (female physicians and midwives) is generally purchased by a cordial reception, a share in whatever dainty morsels the house may offer, and a small present of money. To put it briefly, the native agriculturist does not require much ready cash for his daily necessaries—at least such was the case before European enterprise inundated the country with foreign goods, for some of which the native has since acquired a liking, especially for opium. The use of that drug is a serious drawback to the practice of household economy, as we shall see afterwards; whilst the use of European manufactured wares has made the native forget the art of helping himself.

It is not easy to calculate the yearly income and expenditure of a

native family, consisting, on an average, of four or five persons ; some years ago, judging by what I had heard of the high wages paid by private planters, I estimated it at 130 to 140 fl. as a maximum, but I think that at the present time it will not come to more than £8 or £10. Seeing that the native requires but little money for providing himself with the mere necessaries of life, and that little he can easily earn in an incidental fashion, it remains that the only purposes for which he does need it are to pay his rent and taxes. About twenty years ago, when I was in the south of Bantam, I had to send to the capital of that residency (a five days' journey) for copper coins, for my coolies refused to accept the silver pieces, worth ¼ fl., I had had the precaution to take with me to pay the day labourers, because there was no opportunity of getting them changed.

The question, How much current coin there is in the Dutch East Indies cannot be answered ; some years ago, in 1883, it was set down at 50 million fl. as a minimum, but O. Haupt, *Histoire Monétaire*, estimates it at 191 million fl. at least for the whole Dutch East Indies.

Natives who, by any chance, come into the possession of more money than is sufficient for their immediate wants, either squander it away or invest it in some way or other, but very often they withdraw the coins from circulation.

Let us now see what the receipts and expenses of a common husbandman are. The total produce of rice grown on the Government lands of Java, as I have already stated, was estimated in 1886 at about 70 million piculs of paddy (or 30 to 35 million piculs of rice) whereof 70,000 tons = 1·2 millions of piculs were exported. If we take the population of the Government lands as consisting of four millions of households, there would scarcely be 7·5 or 8·5 piculs of rice for each—*i.e.* about three lbs. per day, which would by no means be sufficient, even supposing each household got a fairly average portion. From this it is at once evident that a large part of the population must have recourse to other food supplies. Throughout extensive districts rice constitutes for the common peasantry only a comparatively small part of their fare. Even after a good harvest, except at the season when rice is just brought home, they have to make shift as best they can to satisfy their appetite ; only the well-to-do can afford to eat rice to repletion.

As a general rule the common husbandman does not cultivate more than three-quarters of a bahu of sawa (although the average is about one bahu), which yields eight or nine piculs of rice, perhaps less. If—and this does not always occur—a second crop is gathered in the same year, the total yield of both harvests may be 12 to 15 piculs, the net return of which, if he could sell it, would be about 35 to 40 fl. But he cannot sell it ; he must make provision for his family, must have seed rice for the next year, must pay his helpers and his debts, and his taxes to the Government. The land tax amounts to about 20 million fl., and this has to be paid by 2·7 millions of agriculturists.

But along with the use of the sawa grounds two other obligations are connected, the *corvées* in the plantations and the *corvées* for general service, both regulated by the Government, and under the supervision of their

officers. Besides these there are the *corvées* for the village communities, which are *à discrétion* of the native chiefs, and, as a rule, are not confined to those who are in possession of sawas. As to the first mentioned *corvées* those in the coffee-gardens demand the most work-people. Nominally a number of families living near the gardens are selected to do the work required in them, as I have described above, but *de facto* the labour is not confined to this; for if the arrival of some high officer coming to inspect the gardens is imminent, the native chiefs put every one to work whom they can get away from his homestead or his fields. Disregarding the fact that this is an abuse of individual liberty, and looking superficially at the statements made with respect to this culture, the reader might fancy that it is a pretty good thing for the natives, especially when he remembers that until the last few years there had been a series of excellent coffee years, the last of which was 1884 ; then followed 1885, rather bad ; 1886, a good average ; 1887, a very bad year. The annual yield has been on an average 950,000 piculs, for which the Government has paid 13·3 million fl. to the natives. The average number of households employed in this work (1882-86) amounted to 628,000, and if the sum paid for the produce of the gardens had been shared among them, the portion of each would have been 18 to 21 fl., a sum which, though not sufficient to pay free work-people, would yet have been at any rate a handsome remuneration. But if we look closer at the question, we get quite another impression. The price paid for the crop is handed to those who bring it to the magazines in proportion to the quantity delivered, but whether this be in proportion to the work really done, no one cares to inquire (*vide* what I have said above as to the chiefs taking work-people, if required, wherever they can get them). Moreover, the quantity obtained is not the same in different years, and in the same years there is much difference in the yield in different residencies. In one year the crop was one million piculs, and 14 million fl. came into the hands of the natives; in 1887 it was $\frac{1}{4}$ million piculs, and 3·5 million fl. were paid down to them; in 1888 it was $\frac{1}{2}$ million piculs, and they received 7 million fl. Now the labour on the plantations is almost the same in every year (apart from gathering and preparing the ripe coffee) whether there be much or little produce ; and it is not only the risk the natives have to face, but there are residencies where a good year is never known—*i.e.* the yield is by no means in proportion to the families employed (or to the trees planted). Thus, while in some residencies the revenue is really a handsome one, in others it is next to nothing ; and in both cases alike this is irrespective of the labour bestowed on the cultivation. To give one instance, in 1886 the average amount of yield for a family in Bantam was 0·5, in Krawang 0·3, in the Preanger Regencies 1·4, in Japara 0·2, in Pasuruan 8·0, in Kadu 1·8, in Kediri 0·4 piculs (in the year preceding it had been 0·1 in Bantam, and 0·3 in Krawang). On the average, therefore, in most of the residencies, the annual yield is between 0·1 to 1·5 piculs, and there are only a few in which it amounts to 8 or 9 piculs. This is the case especially in Pasuruan, where, at the time the plantations after the system of Van den Bosch were laid out, the officers succeeded in making it palatable to the

natives. How many days it takes the natives to do the work required is not easy to say; to get at the figures in a particular instance is, of course, not difficult, but when we try to obtain the average number, we find that the authorities differ greatly. To the best of my knowledge the enforced labour costs the native workmen each from 75 to 160 days in the year; say 100 days, which will facilitate the calculation, for then they each earn from 1 fl. 4 (2s. 4d.) to 21 fl. (35s.) a year—*i.e.* $1\frac{2}{3}$d. to $4\frac{2}{3}$d. a day in most of the residencies; in only a few do they get as much as 126 fl. (£10, 10s.) a year, or 2s. $1\frac{2}{3}$d. per day. But the friends of the natives cannot even enjoy this melancholy satisfaction, that some of them at least, however few they be, gain a high remuneration; where they earn much money they have to do much work, and they have also to engage helpers on their own account to assist them or to do their own work at home. If we study the tabular statements in the *Koloniaal Verslagen*, we see that during recent years the number of families working in the gardens has diminished at a considerable rate (in 1882 there were 722,000, in 1883 710,000, in 1884 689,000, in 1885 547,000, and in 1886 474,000). Now if this diminution represents a real tendency the burden resting on each individual family that remains has become proportionally heavier. It should be mentioned that for the cultivation of coffee 2·6 millions of bahu were still reserved by the Government (1883),[1] whilst only 3·3 millions of bahu are planted by the natives for themselves. I think I need not quote any further figures to make good the assertion that the work in the coffee plantations is a heavy tax upon those employed in it, seeing that they must leave their own plantations, if necessary, to do their duties there. As for the sugar industry, there were (in 1886) 17,454 bahu planted by *corvée*, and 40,762 bahu planted by free labour. For the work first mentioned the owners received 45 fl. per bahu as rent for their ground, and about 125 fl. for the expenses of cultivation. This is a pretty good recompence, but it should not be forgotten that the best *sawas* are taken for this purpose, and that the cultivation requires a great deal of labour.

According to the *Koloniaal Verslag* of 1887, twenty-five millions of day *corvées* were done in 1885, whilst four to five times as much could have been claimed according to the regulations (viz. for the greater part forty-two, for the rest twenty-one or ten days a year from each man subject to this sort of *corvée*). But *l'art de grouper les chiffres* is well understood in the Dutch East Indies; and in some parts of Java, the *corvées* that were levied must have been much more frequent than would appear from the above statements, for we read in the *Verslag* that in order to secure a substitute some natives had paid from 0·10 to 0·60 fl. a day, or from 5 to 40 fl. a year. Generally the natives watch carefully that the *corvées* are fairly shared amongst them, indifferently whether they be a heavy or a slight burden; the villagers are too cunning for it to be easy to cheat them in this respect. The heaviest tax upon the natives, and one which is all the heavier owing to the irregularity with which it is exacted, is the *corvées* in behalf of the village community. No control is exercised

[1] For their own plantations + 147,743 let on lease to planters.

over them by European officers, and if—what seldom occurs—a complaint be brought against a chief on this score, the result is generally a *non liquet*. Now, as I have already stated, the number of chiefs of village communities is very large, and each of them has a staff more or less numerous to assist him in his work. One of his assistants, *e.g.* superintends the irrigation works; there are also a secretary, a priest, a policeman, etc.; the chief is, as it were, the intermediary between the European or native officers and his villagers, whilst his assistants are charged with the execution of the orders given. The chiefs and their coadjutors are exempt from all *corvées*, and their number depends not only on the amount of business to be done, but also on many village intrigues, and the more there are in a village the heavier becomes the burden of the common villager. If the European or native officers are so disposed, the village *corvée* can be made to bear a very wide interpretation: *e.g.* the care of the roads, water conduits, bridges, etc., if destined for the use of *one* village, may come under this head, though, as a general rule, this sort of work belongs to the *corvée* for the Government, or is even paid as public labour. The Government, however, have lately issued orders to prevent an undue extension being given to these *corvées;* but as the officers are directed not to concern themselves with the village *corvées*, only to see that they are kept "within equitable limits," there will always be room for considerable latitude of interpretation. Some Government *corvées* (those done in behalf of the chiefs) have been discontinued (at least in name) during the last few years, and a poll tax of 1 fl. a year has been substituted in their stead. The sum obtained by this means was set apart to indemnify the chiefs for the loss they had sustained. Very soon, however, there was a handsome surplus from this source, and this is now to be expended in behalf of the natives. Although the *corvées* are very burthensome, and the sum of them, theoretically at least, represents a high value, it would be wholly impracticable to abolish them at the present and replace them by a tax in money, however small. There is too little ready money current in the country, and for most of the inhabitants too few opportunities of earning it; the bulk of the population in fact possess no other means of getting money except by working in the plantations or on public works (and in bad years the total sum that comes into their hands is considerably diminished), and for the rest, if circumstances make it necessary for them to have money they are compelled to sell part of their possessions, especially part of their harvest, and this they generally do in order to pay the rent due to the Government, which, as we have seen, is a very onerous charge. From the foregoing it results therefore that the 2·7 millions of native agriculturists have to pay a rent of nearly twenty million fl., besides a charge of two and a half million fl. to redeem *corvées* formerly due to the chiefs, and render *corvées* to the amount of, let us say, five to six million fl. annually, in addition to the *corvées* obligatory in behalf of the village communities. Consequently, on an average, each agriculturist householder has to pay the comparatively large sum of 10 fl. (Of course these figures are only a rough calculation.) And here we find a regular *annulus vitiosus*. If the rice prices be low, a husbandman must sell more paddy in order to pay his rent, *ergo* a less quantity is left

to him wherewith to satisfy his hunger, and although prices are not high we may hear of famine. But if the rice prices are high, which is generally the case if the harvest has been small or there is a large demand for export, then he has not of course to sell so much, but the high prices tempt him to reduce his stock, and the momentary satisfaction he enjoys is in this case also often followed by distress and famine, and the more so since the share in the harvest that falls to the helpers is less than usual as compared with what they get when prices rule low.

Various indications show that the burden laid on the native cultivators of the soil has been really too heavy for them; it is only of late that the quantity of rice exported has exceeded the import of it—though, as I have said, the whole harvest would not be sufficient for the natives. There is in the treasury plenty of coin, which keeps flowing back to it, and in some residencies the natives are beginning to sell their trinkets to get ready money; all these are symptoms of impoverishment. At last the Government have awakened from their lethargy, and a real intention to alleviate the condition of the husbandmen, the backbone of the population, is manifesting itself.

Other classes of the population do enjoy greater opportunities of earning extra money, for they are not so tied to the ground, and are not subject to such heavy taxes.

Opium and Salt Monopolies.—In addition to what I have already said, the Government derive their income, as far as the natives are concerned, from different sources, among which I may mention, in the first place, the opium and the salt monopoly. Opium has been an article of luxury to the natives of the Dutch East Indies for many generations, and the Government continue to profit from their predilection for it; they buy the drug in foreign countries at a cheap rate, and sell it to their subjects through the mediation of licensed traders (all of them are Chinese), who, besides having to pay for their licence, buy the drug from the Government at advanced prices, but only a certain quantity (maximum) is allowed to each trader. I will not enter here upon a discussion of the vacillations the opium policy has undergone,[1] both under the system of Van den Bosch as well as later; I will merely observe that the principle which is said to guide the policy of the Government is that of discouraging the natives by high prices from the use of opium. One consequence of this system is (or, let me rather say, is said to be) the prosecution of opium smugglers in every way that is open to the authorities. But judging from the sum set apart for this purpose (fl. 380,000 in 1883, fl. 400,000 in 1888) this task is not regarded in a very serious light. It is also alleged that everything possible has been done in this matter that could have been done, but, as we shall see, most probably with little success. According to reports from the Dutch East Indies, which seem to be borne out by the tabular statements I shall adduce presently, the lucrative

[1] Perhaps I may refer to a paper of mine in *Revue Coloniale Internationale*, 1887, ix. and x., printed also in *Oesterreich. Monatsschrift für den Orient*, 1887, x., xi., and xii., and *ibid.* 1888, vii.

business of opium-smuggling thrives apace, and yet, what seems very surprising to one not thoroughly conversant with the question, the sums paid for licences to trade in Java have increased of late.

They amounted to 10·7 million fl. in 1881.
„ 10·5 „ „ 1882.
„ 10·5 „ „ 1883.
„ 12·1 „ „ 1884-86.
„ 13·0 „ „ 1887.

But, strange to say, the quantities, which the licence-holders have bought very dearly from the Government, have decreased from year to year; the total was—

1881, . .	165,650 catties.[1]	1884, . .	164,052 catties.
1882, . .	150,938 „	1885, . .	129,877 „
1883, . .	130,163 „	1886, . .	104,420 „

These figures indicate the quantities really consumed, not what the licence-holders were allowed to purchase from the Government ("the maximum"); the quantities they cannot sell, they are allowed to return to the magazines. In 1881 and 1884, being the first year of a three years' term, they took more than usual; the reasons for this would take too much space to explain here.

A consideration of what I have said above suggests two questions, viz.: (*a*) what is the reason that, notwithstanding the falling off in consumption, the licence-holders have paid more for their licences? and (*b*) what is the cause of such a notable falling off?

Of the former question two alternative explanations are possible; either the licence-holders can make a larger profit on smaller quantities, or they have some other means of getting the drug cheaper than it is sold to them by the Government. Now, it has long been known that it is difficult for them to make a price sufficient to compensate them for the sums paid for the licences and the expenses of their business. Smuggled opium being cheaper than opium sold by the licence-holder, the amount of the former would have to be reduced almost to nothing, before the licence-holders could make higher prices. The falling-off in the consumption might be set down to one of three different reasons, viz.: (1) The Javanese may have begun to repent of their sins and give up opium-smoking; but it is scarcely probable that this is the case, at least to the considerable extent implied in the figures above mentioned. (2) They may have become so impoverished as no longer to be able to afford to consume the drug. Now, as I have stated, there are some symptoms of impoverishment, but opium-smoking is not widely prevalent among the class who suffer most from unfavourable seasons and unfavourable markets (the husbandmen) as it is among other classes, hence it seems improbable that the sudden falling-off in the use of opium can have been caused by impoverishment alone. (3) The consumers may have discovered some way of getting the drug cheaper than they could buy it of the licence-

[1] A catty = 1¼ lb. avoirdupois.

holders, *i.e.* they may use smuggled opium. On combining the answers given to (*a*) and (*b*), it follows either that smuggling must have been checked to a considerable extent and the consumption in a proportionate measure diminished, or that the licence-holders themselves take part in the smuggling, and therefore purchase the merest minimum from the Government at high prices to save appearances. The latter is unquestionably the more probable explanation, for if the former had been the case, plenty of money would have been left current in the hands of the natives, and instead of impoverishment there would be comparative wealth. There is no reason to believe that the retail prices had become so high as to yield to the farmers more than the usual compensation after they had been indemnified for the higher rates paid for the licences. Accordingly Government, by raising the price for the licence-holder, offers, as it were, a premium to smugglers. The total sum paid by the licence-holders to the Government for their licences and their supplies of the drug, increased by their other expenses, is (for Java alone) estimated at more than 20 millions of florins; now no one would, I think, assume that the licence-holders would ever run such great risks as this implies, if they had not the prospect of making a considerable profit. How much this may be estimated at it is impossible to say, but the total amount spent in opium by the inhabitants of Java I have reckoned[1] at 50 to 55 millions of fl., of which amount the natives contributed by far the greater part. Hence, considering that it is comparatively the smaller part of the population who indulge in opium-smoking, it will be evident what an expensive item this is in the expenses of a household, the members of which are addicted to the habit. The profit the Government derives from opium amounts to about 20 million fl. for the whole of the Dutch East Indies.

With a few exceptions, too insignificant to be mentioned here, the preparation and sale of salt, for the greater part of the Dutch East Indies, are a monopoly of the Government, a privilege inherited from the rule of Raffles. The natives are paid 10 fl. for preparing 1 koyang (=30 piculs= about 4000 lb. avoir.); the total charges and expenses for transportation, administration, etc. are estimated at 2,083,000 fl. (in 1888); and the quantities actually sold amounted in 1886 to 953,727 piculs in Java, and 192,713 piculs in the islands exclusive of Java. If we start from this sum (1,146,440 piculs) the expenses are calculated at 1·815 fl. per picul, to which 0·335 per picul must be added for preparing the salt; thus the total cost of production of a picul amounts to 2·15 fl. Now in Java a picul is sold at the average price of 6·50 fl., therefore the net profit made by the Government amounts to 4·35 fl. per picul or about 4 million fl. altogether in the year, which is equivalent to about 0·18 fl. per head of the population. The sacrifice, however, that the native has to make to get his share of salt is still greater; most of them can only procure it at second or at third hand, for in the Government magazines the smallest quantity sold is $\frac{1}{3\frac{1}{2}}$ picul (and there is still another drawback—whilst bought by *weight* it is sold by *measure*). Moreover, there seem to be

[1] See my paper above mentioned.

many abuses connected with the magazines; and the managers bear all over the Dutch East Indies a nickname which I do not wish to repeat here (*vid. Indische Brieven*, by Eckart, p. 18), to express that they get higher profits than are provided for in the regulations. But the worst feature connected with this trade is the large number of middlemen, and it is said that the retail price paid by the common native who purchases salt in a village market comes to 25 fl. to 30 fl. a picul, which is 12 to 14 times as much as it costs the Government. This should at all events, I think, be prevented; for the salt that is consumed in Java is no article of luxury, and if the Government cannot do without the profit derived from the monopoly, they should at least take care that the natives are not drained to the unjust extent that they are now.

Minor Sources of Government Revenue.—I now pass over to the minor sources of income, which are directly or indirectly derived from Europeans, Chinese, Arabs, and natives, each nationality being subject to one or more.[1] In the first place I must mention the sums paid for licences by pawnbrokers, who are almost, without exception, Chinese; the licences are sold to the highest bidder, and the revenue derived from them in Java amounts to about a million of guilders annually. The history of this part of the revenue is again a very melancholy one, but it is so significant of the spirit that has animated some of the rulers of India, that, unpleasant as it may be to advert to it, I cannot help dwelling on it for a moment. Up to the year 1869 the custom that now prevails was in force; licences were sold to the highest bidder, authorising him to lend sums less than 100 fl. upon pawn, on conditions stipulated by the Government; in the year above mentioned this system was abandoned on the ground that it was injurious and oppressive to the natives. Since then there has been no restriction on the number of licences issued, every person of good repute being able to procure one by paying an initial fee of 50 fl. together with a certain annual payment, the amount of which depended on circumstances. The number of pawnbrokers therefore increased rapidly. But this business was often made a pretext for smuggling opium; on the other hand, however, the competition forced the pawnbrokers to deal with the natives on more lenient terms; meantime the treasury made only about 50,000 fl. a year, whereas under the old system it had realised ten times as much. At last, in 1880, the Government returned to the former system; in the beginning measures were taken to protect the natives; more especially, regulations were drawn up for the purpose of preventing the pawnbrokers from selling unredeemed pledges immediately upon the expiry of the period of loan. Thereupon Mr. van Lansberge, at that time Governor-General, finding that there was not competition enough for licences, was compelled to cancel the paragraphs that were objectionable to the pawnbrokers, and to hand over the natives to their tender mercies, after which they not only charged extortionate rates of interest—up to 90 per cent. for small sums—but very often

[1] Fortunately I received Mr. P. Brooshaft's *Memorie over den Toestand in Indie* just in time to allow me to take a few striking features from it.

contrived to keep possession of their goods in the end. It would take too much space to describe all the misery the natives have to endure from these blood-sucking Chinese, who do not confine their practices to pawnbroking only. To characterise the system followed by the late Secretary for the Colonies, Mr. Sprenger van Eijk (who held office from 1884 to 1888), it will be sufficient to mention that 114,000 fl. were paid for the licences in 1880, which sum had increased to 600,000 fl. in 1883; but under his administration it came to 1,065,000 fl. This result could only be achieved through connivance of the authorities at the practices of the Chinese pawnbrokers.

The new regulations affecting the duties for carrying on trades and handicrafts (levied upon Europeans under another name), which are actually in force, date from the year 1878. As a rule all natives pay 2 per cent. of the income derived from their calling; other Orientals, including Chinese, 4 per cent. When the law first came into force, it was intended that the minimum amount paid should be 1 fl., and accordingly most of the officers charged with the assessment of the taxpayers freed all those whose income did not exceed 50 fl. a year. *O sancta simplicitas!* was the cry at the Treasury. What a stupid interpretation of the wording of the edict! According to the terms of the enactment, it is provided that the minimum duty shall be 1 fl. per head, consequently whatever the income, even though it be less than 50 fl., the taxpayer must pay at least 1 fl. And so it was decreed and done!

I should mention here that up to 1885 Chinese, Arabs, and other Orientals had only to pay 2 per cent. like the natives, but since the revenue accruing from the tax was not sufficient, double the usual rate was at once imposed upon them, and, as I have said, they now pay 4 per cent. In this way the Treasury succeeded in augmenting the number of persons liable to these duties from 634,471 (in 1878) to 868,109 (in 1886), and in running up the sum paid by them from about 1,900,000 fl. to 2,712,306 fl. in 1886 (all the figures quoted refer to Java alone). Though —or more properly said because—the majority of the incomes which pay on this tax are small, it is felt to be a heavy charge, worse perhaps than the tenth-penny once was. Through these duties the Government extracts a very large proportionate sum of money not only from the natives but also from the Chinese, and if the question were not so serious, the proceedings would sometimes seem almost ridiculous. "John Chinaman" is not a pet anywhere, and, therefore, does not get much pity in the Dutch East Indies, where the Treasury deals a little hardly with him, and plucks him feather by feather. To give only one instance, I may add, that "living on one's income," as far as the Chinese are concerned, is classed as a profession in the Dutch East Indies, at least those who are fortunate enough to be in this position have to contribute their part of this tax (called in Dutch, *Bedrijfsbelasting*), though they may also pay on the principal as well (*e.g.* if it is out on mortgage, $\frac{1}{2}$ per cent.). As for the minor sources of income I will group in a tabular statement the various revenues obtained from licences, etc., for the year 1887 (budget), or, as far as is known, those that were really paid in 1886:—

	Java Licences.	Islands exclusive of Java.
Opium,	16,247,640	3,912,465
Slaughtering Buffaloes,	1,208,292	...
Gambling,	262,776	...
Slaughtering Pigs,	62,406	...
Ferries,	120,172	...
Birds' Nests,	138,660	...
Pawnbrokers,	965,214	...
Miscellaneous,	302,556	1,548,789
	19,307,716	5,461,254
Total,	24,768,970	

Levied by the Government directly—

1. Import and export duties (really paid in 1886) and rent for the magazines :—

		Florins.
(*a*) Java and Madura,	fl. 7,233,948·00	
(*b*) Islands exclusive of Java,	1,331,377·00	
		8,565,325·00
2. Excise on spirits, home distilled,		68,347·00
3. Excise on tobacco :—		
(*a*) Java,	fl. 93,387·00	
(*b*) Islands exclusive of Java,	10,435·00	
		103,822·00
4. Personal duties :—		
(*a*) Java,	fl. 711,088·25	
(*b*) Islands, etc.,	131,728·72	
		842,816·97
5. *Patent* (Duties on professions, trades, and handicrafts carried on by Europeans) :—		
(*a*) Java,	fl. 603,084·46	
(*b*) Islands, etc.,	166,499·75	
		769,584·21
6. *Verponding* (a due paid according to the use made of the soil and the income derived from it) :—		
(*a*) Java,	fl. 1,660,435·32	
(*b*) Islands, etc.,	111,775·35	
(*c*) Banda (Nutmeg plantations),	87,383·90	
		1,859,594·57

If this be compared with the total revenue given on p. 570, it will be seen that the burden imposed on the native population, especially on the agricultural part, is very onerous, whilst the means wherewith to satisfy the claims of the Government are exceedingly small. It is asserted that the natives, by working in private plantations, under the most favourable circumstances, can earn a gross annual total of 35.000,000 fl. ;[1] but even if we assume that this estimate is too low (which I myself

[1] By Dr. Gelpke (Inspector of the Rice Culture) in his *Eind. résumé.*

believe it to be, when the circumstances are very favourable), and raise the total sum to 40 or even 50 millions, and then add to it the sum earned in the Government plantations, the result still remains the same, that it is rather a difficult task for the natives to satisfy the demands of the Government under these circumstances. Therefore, I think that the natives of Java, though in some respects better off than those on the other islands exclusive of Java, will not be envied by their fellow-subjects living in other parts of the vast territories of the Dutch East Indies, though the latter, in part at least, have not yet acquired the least tincture of European culture, and here and there are still sunk in the practices of crass savagery—*e.g.* head-hunting and cannibalism—whilst the benefits of civilisation, schools, and re-vaccination are, of course, for the greater part, utterly unknown to them.

Yet the population of Java possess strong powers of vitality, and, as far as I am able to judge, may surmount the hardships that have come upon them, if the Government will only assist them in a really liberal manner. A glance at the figures given immediately below will show the considerable increase they have undergone since the middle of the century. The native population amounted to :—

1849, . .	9,584,130	1879, . .	19,048,281
1859, . .	12,324,095	1884, . .	20,665,510
1869, . .	16,010,114	1885, . .	21,190,626
1874, . .	17,882,396	1886, . .	21,716,177

Increase at this extremely rapid rate is really astonishing, especially when we consider that it does not take place equally on all the islands alike. Some residencies indeed show a *cessation of increase*, or even a considerable diminution—*e.g.* Bantam, where, in 1879, 760,463 natives were reported, whilst in 1886 their number had gone down to 544,321. This decrease is only to a comparatively small extent (about 30,000) attributable to the eruption of Krakatoa; the rest have been carried off by famine, disease, and emigration.

European Planters.—In saying a few words on the condition of the European planters, I shall confine myself chiefly to those working under contract. Those who are really owners of the ground, and possess feudal rights, are in a condition which is, in certain respects at least, an anachronism, and which should be altered—the sooner the better. As things are now, the owners pay their taxes and duties, whilst the Government exercises merely a general superintendence over the estates, provides police (though they are paid by the owner), and acts as the protector of the natives in cases where they are ill-treated and abused. This last is a very delicate matter. It frequently happens that disputes arise between the proprietor and his tenants, and thus plenty of opportunities occur for the intervention of the Government. It depends especially on the tact and goodwill of the officers whether the difficulties that have arisen be speedily removed or not. If, however, the officers fail in their duty, or any bitterness prevails, things grow worse and worse, of which a deplorable instance is seen in the late occurrences on the *Tjiomas* estate.

Passing over to those cultivators who work under contract, I must beg the reader kindly to remember that I have already, in the introductory part of this paper, hinted at some of the difficulties with which they have to contend. Besides those already mentioned, I may state at once that the same vacillating policy that has distinguished all the actions of the Government for a long series of years past, has likewise characterised their attitude towards the planters. Instead of working amicably hand in hand with each other, which would have contributed very much to sound economic progress, there has very often been a jealous rivalry between them and the officers of the Government; indeed the Government itself frequently considered the private planters as intruders, against whom it was their duty to protect the natives, and whose competition was a matter for serious consideration. Moreover, money-making having become a settled habit with the Government, prevented them from reflecting that after the old system was once abandoned they could not do better than assist the private planters by all the means in their power in developing the country and unfolding its natural resources. But instead of pursuing that enlightened policy, they have hampered them with heavy duties, a proceeding all the more unreasonable, since after the ice was once broken and a decisive alteration had taken place, the European planters, and the money they imported into the country, could not be spared. It is an unquestioned fact that where flourishing (if any such there are now) plantations have arisen, there flourishing villages have sprung up, and that the decay of the latter is concomitant with the decline of the former. There is yet another reason which the planters might have appealed to in their own support: the system of Van den Bosch having been once abandoned, and the natives not possessing the money necessary for laying out plantations on a large scale, it had to be done by European enterprise, supported by European capital, if the ground was not to lay fallow, and the treasures that were hidden in it to remain concealed for ever. But the spirit of money-making being rampant, the mistaken policy of extracting as much money as possible by way of duties from the planters still maintained the upper hand. In the first place they have to pay a tax called *canon* for the right to use the ground, a kind of material acknowledgment of feudality — though, properly speaking, it should be only a recognition of the sovereign supremacy of the Dutch Colonial Administration—in return for which the planters are entitled to the protection of the Government, and all the advantages which naturally accrue to the subjects of the latter. In the Dutch East Indies this tax is assessed, not only in proportion to the area, but to the fertility of the soil and other circumstances. In consequence of the keen competition it has often been driven up to an amount which, when circumstances are unfavourable, as has been the case of late, cannot be paid; in some instances it exceeds even more than 16 fl. a bahu (about 15s. 3d. per acre). As long as the plantations were prosperous, they were able to afford it, but after the present series of years had set in and the yield diminished, solicitations were made for the purpose of getting a fixed low tax established in proportion to the area the planters wished to hold at lease. At length the Government found

themselves compelled to yield to the pressure brought to bear upon them, and lowered the tax. It will, however, profit only the planters of the future; it offers no relief to those who are already struggling under the old *régime*. And after all it is not even yet a uniform tax, for certain differences are still to be made. It may be mentioned that generally the full amount of this tax is not paid at the time the plantation is laid out, but in the beginning only a part of it, the contributions increasing annually till by the time the plantation is supposed to be in good working order the full sum is discharged. The planters have to pay yet another tax on the ground called *verponding*, the amount of which depends on the income or the value the ground has acquired through the labour of the planters, or the buildings he has erected—in short, on the "unexhausted improvements" he has effected. This tax is not paid for the first five years after the plantation is laid out, and that term has now been extended to ten years. After all that has been said about the Government endeavours to force up the taxes and duties, the reader will not be astonished to learn that numerous complaints exist as to this tax also; in particular, it is averred that undue latitude of interpretation has been given to the law. A third tax that the planters have to pay is the poll-tax, levied on all the work-people living on their estates. This amounts to 5 fl. a head a year, and is regarded as the compensation due to the Government for the *corvées* they have ceased to exact. When the abandoning of this tax was under discussion in the States-General, the Secretary for the Colonies himself acknowledged that it was an unjust one, since most of the persons the planters had to pay for were not liable to render forced labour. The tax was therefore discontinued from that time; but for the craftsmen they employ, private planters still have to pay duties on the trades and handicrafts.

Besides the above, the planters incur also their share of the export duties, which up to 1886 amounted to:—

Per kg. of indigo,	fl.0·10.	After 1886,	fl.0·10.
100 kg. of coffee,	3·00.	„	1·00.
„ „ of sugar,	0·30.	„	0·15 (discontd. 5 yrs.).
„ „ of tobacco,	1·00.	„	1·00.
„ „ of tea,	1·00.		...

To counterbalance the diminution of revenue owing to this relief, the import duties for most articles were raised from 6 per cent. to 10 per cent. *ad valorem*. Instead of the duties on trades and handicrafts, Europeans pay 2 per cent. under the name of *patent*. As I stated above, some of the sugar-planters have part of their estates planted through the mediation of the Government, for which they have to pay a *cijns*, which comes to 2 to 3 fl. per picul; the term of payment for *this tax has been postponed for five years*. Those planters who had their cane planted by free workmen, without the help of the Government, had to pay to the latter 25 fl. per bahu. This import has, however, been discontinued since 1886.

Again, notwithstanding all the *corvées* laid on the natives, in some parts of the country the security afforded by the police leaves much to

be desired, and the planters have sometimes to concert measures to enforce it themselves, which is rather expensive. In the other islands of the Dutch East Indies, exclusive of Java, planters *in spe* are said to receive still less encouragement than their *confrères* in Java; indeed, if the planters in Deli had had to deal with the Government from the beginning, instead of with a native prince, it may safely be inferred that they would never have been able to boast of such excellent results as those they really have achieved.

There remains still one financial topic to which I must advert. In 1877 the gold standard was introduced in the Netherlands and in the Dutch Indies, and by this measure great injury and loss were inflicted upon those who export goods from Java, especially as the value of the exports greatly exceeded that of the imports. This, however, is a very intricate and difficult subject to handle; for, apart from other considerations, it is doubtful whether silver has been depreciated below or gold has risen above its normal value, or whether each of these tendencies has manifested itself to a proportionate degree. Suffice it to say that at the present time some of those who are best acquainted with the East Indies are of opinion that the situation would be greatly improved if the silver standard were again reverted to. This question is one of the utmost importance, affecting vitally the financial and economic progress of the Dutch dependencies in the far East, and more especially the financial position of the planters, since, if we bear in mind the competition of their rivals, the planters in British India, it cannot be denied that those in the Dutch East Indies have suffered a serious loss by the introduction of the gold standard.

Now, as the reader will remember, about two years ago measures were taken to relieve the planters to some extent, and since then *even* Mr. Sprenger van Eijk himself, when Secretary of State for the Colonies, perceived clearly that in the case of the natives the bow had been strained too tightly, and there are not wanting reasons for believing that his successor, Mr. Keuchenius, will follow out his policy along the same lines, and effect an alleviation of their economic condition on a still more considerable scale. For instance, it seems almost certain that a remission of several millions of guilders will be temporarily granted on the land tax. It may indeed be hoped that this temporary relief will be continued, and made perpetual if need be, to allow a hardly-pressed nation time to breathe, and to enable the European planters to carry out their plans for the development of the Dutch East Indies, which it may safely be believed their enterprise and industry would not fail to accomplish, if they were properly assisted by the Government. It is a very curious circumstance, and a proof that the late Secretary of State does not entertain the most hopeful view of things in the Dutch East Indies, that since retiring from his official position he has joined a private company (I don't exactly know whether as a manager or a director) that is being started at Amsterdam for planting tobacco, *not* in the Dutch East Indies, but in British North Borneo,—a bad testimonial indeed to the former by their late ruler.

But apart from all efforts to effect the utmost possible improvement

in the actual economic situation, there is yet another lesson to be learned from the adverse times through which they have just passed, viz., that it is dangerous for the Government to be both ruler and farmer at one and the same time.

I have now arrived at the end of the task I proposed to myself. Many statements (*e.g.* about commerce and trade), which can be obtained from any good book of reference, I have been compelled to pass over in order not to extend this paper to an excessive length. The facts which I have here brought together and put before the reader will, I believe, be sufficient to substantiate my assertion that the present unfavourable condition, economical and financial, of the Dutch East Indies is to be attributed for the greater part to the "buffets of Fate" to which they have been of late exposed, and to the unskilfulness and narrow-mindedness of their rulers; but I also believe that it is not yet too late to amend even those failures which have been as it were intentionally committed, and to set to work to effect a thorough amelioration in the economic and agricultural condition of the Dutch possessions in the East. And unless I am greatly deceived, we may safely venture to prognosticate that the dawn of better days is even now indeed breaking on the horizon.

RUSSIAN TOPOGRAPHICAL SURVEYS.

By E. Delmar Morgan, F.R.G.S.

(*Read at Meeting of British Association, Bath*, 1888.)

The corps of Russian military topographers trained at Tiflis and other places has done valuable work, especially in connection with Central Asia and its border lands, in all those regions opened to the scientific world during the last few years. Every reconnaissance, whether military or scientific, has invariably been accompanied by one or two or more of these officers, who, besides plotting routes and drawing maps, have collected a vast amount of geographical information, not unfrequently illustrated by their drawings, sketches, photographs, etc. To give a mere outline of the work done by them in 1887 would occupy too much time, and I will therefore confine myself to briefly alluding to special regions.

In European Russia, a survey on the scale of one-third of a mile to the inch has been accomplished of parts of the Government of Wyborg, previous maps of this part of Finland having been based on the Swedish surveys of the eighteenth and beginning of the nineteenth centuries. The new maps contain much new orography, and delineate with accuracy the lake region, which occupies so large an extent of Finland. The same scale (one-third of a mile) has been adopted for the districts around Warsaw and the province of Volhynia, the relief of the country being shown by *hasuring*. During the progress of this work, it was observed that changes had taken place in the face of the country during the forty years that had elapsed since the last surveys, owing to the destruction of forests, the sub-division of villages—the inhabitants having a tendency to separate and form new settlements—and the new directions taken by trade routes consequent on the construction of railroads.

In Turkestan, the five-verst reconnaissance was continued not only of the Syr-daria, Amu-daria, and Ferghana regions forming altogether the military province or General-governorship of Turkestan, but also of the neighbouring states of Shugnan, Darwaz, and Karateghin, as well as of the Bokharan and Khivan dominions. Upon the completion of this rough survey the forty officers engaged upon it were divided into parties, some of them being employed on the large scale (one-third of a mile) survey of the cultivated lands, while others made a two-verst survey of the mountainous almost uninhabited tracts. The particular points dwelt upon in their reports are—first, the increased area of cultivable land in the vicinity of Tashkend since the construction of new irrigating works; second, the region west of Chimkend is described as a lofty undulating steppe, sloping gradually from the watershed of the Kazi-gurt range to the Arys and Syr-daria, wells occurring at intervals of three to sixteen miles, containing water of a bitter saline taste, a fact, however, which does not prevent the nomads from pasturing their flocks here till the season of intense heats has burnt up the grass.

In the Samarkand region, a systematic survey has been continued on the larger scale (one-third of a mile) in the districts of Samarkand and Katta-kurghan. From this it appears that the environs of Penj-kend are very hilly, broken by frequent ravines and dry water-courses with steep banks, and irrigated by a network of dykes supplied by three brooks. But the water supply is scanty, and its quality exceedingly impure. The difficulties of surveying in such broken ground are aggravated by the daily occurrence of sandstorms which sweep over the country about midday, putting a stop to all work. During 1887 fever was endemic in the Katta-kurghan district, and typhus in the settlements between that place and Bokhara, 50 per cent. of the inhabitants having been attacked by it.

In Ferghana the two-verst survey was continued in the mountainous districts of Kokand and Marghilan, bounded on the west by the river Sokh, and on the south by the Katran mountains. The waters flowing northward from this range are exhausted in irrigating works; while the southern slopes are devoid of all irrigation, arid, and uninhabited. The region, however, is not without natural resources, for in the outlying spurs of the district of Pitau, seven miles from Rishtan in Ferghana, there are sulphur springs, used till within the last year or two for medicinal purposes; and two miles to the east of these are springs of naphtha, hitherto only used by the Kirghiz for illuminating purposes.

In Bokharan territory, it has been ascertained that the left bank of the Surkhab for about 50 miles between Gharm and Aktai is much more fertile than the right, and that even in the higher mountains corn is successfully raised by the natives, who carry it on sledges to their villages. Beyond Aktai the elevation becomes so great as to prevent agriculture in all that region bordered by Peter-the-Great range on the south, and on the east by the Muk-su. Here the early setting-in of cold weather prohibits cultivation. About the 27th August the rivers are frozen, and the valleys covered with snow. The inhabitants, unable to provide themselves with the necessaries of life at home, travel to Ferghana, where they hire themselves out as porters in the bazaars, or wash gold in the defile of Altyn-Mazar. This defile is only accessible at

the end of September, when the snows have ceased melting on the mountain summits. According to another report ironstone is plentiful in the Angaran-sai, the parent stream of the river of Baisun. Furnaces of a primitive kind are constructed by the natives to run off the metal into moulds, but the ore is not particularly rich. In a third quarter, representing an area of 1757 square miles, bounded on the south by the Amudaria, between Kelif and Kerki, consisting partly of sandy plains and partly of hills, clothed during the rainy season with grass enough to pasture large flocks of sheep, an abundance of excellent rock-salt was discovered, entire hills being found to consist entirely of this valuable commodity. It is here that from time immemorial Bokhara has obtained her supplies of salt, and the supply is inexhaustible.

The Omsk section of the topographical department has during the year 1887 employed no less than eighteen surveyors on the two-verst survey of the region bounded by the Tarbagatai range on the north, the western spurs of the Barlyk mountains on the east, the Dzungarian Ala-tau on the south, and the meridian of Lepsinsk station on the west. The northern and southern belts of this region are filled in with mountains, of which the Dzungarian Ala-tau reach the limits of perpetual snow, while the central portions are occupied by the lacustrine system of the Ala-kul and its subsidiary lakes. From the hypsometrical measurements, made at 1500 points, it appears that while the Dzungarian Ala-tau peaks reach a height of 14,000 feet, and the Tarbagatai mountains are between 6000 and 7000 feet high, Lake Ala-kul, lying about midway between the two, has only 750 feet of absolute elevation, and lies in the lowest depression, all the other lakes and rivers draining into it.

A route survey on a five-verst scale has been run along the left bank of the Ili to its discharge in Lake Balkash, showing that from Iliisk, for 210 miles to its mouth, there is not a single inhabitable spot on the left bank.

The region visited by a severe earthquake on the 9th June of last year,[1] by which the town of Verny was destroyed, has been lately surveyed, and its geology investigated, by Professor Mushkétof. From these labours it appears that no better site for rebuilding that town can be found than the old one, undeniably the best in the whole of Semiretchia.

In the Caucasus, where the first triangulation dates from the year 1847, the large-scale survey has been continued in the region of Piatigorsk, well known for its mineral waters, and in the neighbourhood of Fort Vedeno, regions fissured by innumerable deep ravines, presenting great obstacles to the topographer. The one-verst survey was extended to that part of the main range where the peaks of Dykh-tau and Koshtantau, the sources of the Baksan, and Mount Elbruz are situated. A region wild, rugged, and inaccessible, with a scanty and poor population, and a climate so humid that, out of 135 work days, each topographer could only reckon upon thirty-five to eighty-three for observations, and even on these, only from two to three hours on the average were available owing to the mountain summits being obscured by mists and fog. One surveyor was working on Elbruz at elevations never below 10,000 feet,

[1] *Cf.* Proceedings R.G.S., October 1888.

and ascended this mountain to a height of 15,750 feet. He was constantly in a region of perpetual snow and ice, exposed to all kinds of privations and hardships, and running the risk of falling down one of the deep crevasses which seam this giant mountain's side. Added to this, the weather was most unfavourable; in June and July nothing could be done, and early in October winter set in. On both these Caucasian surveys the relief of the country is expressed by contouring lines.

In the district of Krasnovodsk, in the Trans-Caspian province, a line of survey was run along the railroad, opened this summer to traffic. Here it was the very opposite climatic conditions that impeded the survey. With hardly a rainy day, the sands became so heated by the sun's nearly vertical rays that it was painful, and at times impossible, to march over them, while the strong north-easterly winds raised the fine sand in thick clouds, rendering the work of surveying impossible. Mirages and the tremulous motion of the lower strata of atmosphere obliged the observers to discontinue work before eleven, and only resume it after three or four o'clock in the afternoon. The localities surveyed include the Balkhan hills, with their precipitous cliffs and sandy saline deserts, untrodden by man's foot.

The Amu-daria oasis, or the strip of fertile land aligning the river-bank, was surveyed on the one-verst scale both before and after the Russo-Afghan Boundary Commission, an instrumental survey of about 200 miles along the course of this river, between the towns of Kilif and Dinau, having been accomplished. This was one of the most difficult tasks undertaken by the topographers, owing to the absence of any elevated or prominent features to serve as points of observation. Added to this were the difficulties arising from the densely-peopled nature of the country, the depth of the irrigation-dykes, and the number of detached houses and sheds surrounded by high mud walls and fields of tall maize. Fortunately the population were well disposed towards the surveying parties, and ready to lend assistance where needed. Owing to the level nature of the country but few observations for altitude were necessary, the fall of the river being ascertained to be 180 feet in 140 miles, or 1·29 foot per mile.

In the sand desert a survey was made in two directions—(*a*) between the Murghab and the Amu-daria; and (*b*) between the Trans-Caspian railroad and the Russo-Afghan boundary. The scale adopted in either case was 5 versts ($3\frac{1}{3}$ miles) to the inch. 2000 miles of itineraries were travelled by the topographers, the positions of 425 wells were ascertained, and 158 observations with the aneroid were recorded. The whole of this region is waterless and uninhabited, the wells are from 50 to 100 miles apart, most of those discovered lying along the border of the cultivated land. Vegetation, however, though uniform, is abundant in all that belt, extending from the border of Afghanistan for 100 miles, in the direction of the railroad, where there ceases to be any. In the same way there is a belt of vegetation 20 to 40 miles wide along the Amu-daria oasis. Beyond it are shifting sand-hills, devoid, or nearly so, of vegetation. The moving sand-dunes, which occur in the immediate vicinity of the cultivated land, are probably caused by the practice the inhabitants have of collecting the grass and roots in autumn, to provide their horses

and cattle with fodder during winter. The total area covered by this survey was 10,326 square miles, consisting entirely of plain country, sloping a little towards the north. In its eastern part traces of a dry river-bed were evident, in a direction almost parallel with the Amu-daria, but gradually deflecting from this river towards the north, till the channel disappeared altogether under sand-drift, about 30 miles to the south-west of the village of Islam. This river-bed is shown in part on the maps of the Boundary Commission. It appears to start from Kelif, and may be observed some distance from it, about 8 miles from the Amu-daria. In spring water finds its way into it from the Akcha rivulet, and probably runs down its entire course to the point of its disappearance in the sands. The floor of this river-bed is hard clay, known locally as "takir;" the numerous wells found in the channel itself, and in its vicinity, contain nothing but salt water.

In the south-western corner of this wilderness there remained a tract of 1757 square miles of absolutely arid desert without wells or roads. This tract was omitted from the survey.

In Siberia there are three sections of the Military Topographical Department—one for Western Siberia, with headquarters at Omsk; another for Eastern Siberia, with Irkutsk for its centre; and a third for the Amur provinces, quartered at Khabarofka. Allusion has already been made to the first of these; the second, that of Irkutsk, was engaged during the summer of 1887 in mapping the border-lands of Mongolia and the region lying to the south-west of Lake Baikal, bounded on the south by the upper waters of the Yenisei and the Sayan range. Here 1300 miles of itineraries were plotted, and a sufficient number of astronomical points determined. Lastly, in the vast unexplored territory watered by the Amur and its tributaries, a survey was made by Prince Daleshkaliani, an official attached to the staff of the Governor-General, whose report contains much information on the nature of the country, its flora and fauna, as well as the manners and customs of the inhabitants. Two other maps, one of an itinerary in Eastern Mongolia, by Colonel Harnak, of the Staff Corps, and the other of a route from Peking to Mergen, have also been contributed to this section.

Turning to the work of the Russo-Afghan Frontier Commission, I am indebted to Colonel Kuhlberg, the chief Russian Commissioner, for his pamphlet[1] containing some interesting remarks on this subject. It will be in the recollection of all here that upon the establishment of the Russians at Merv, in 1884, their boundary became immediately contiguous with that of Afghanistan, and it was then important to define exactly the northern border of this country. Our Government entered into relations with that of Russia with the view of coming to an understanding with them. I need not remind you of the various negotiations which took place, and of the incidents which at one time threatened to end in a rupture between the respective Governments. Suffice it to say that, in the winter of 1885-6, the surveying parties assembled and made a series of observations along the whole north-western frontier of Afghanistan,

[1] *Raboty Afghanskoi razgranichitelnoi Komissii i nasha novaya granitsa s Afghanistanom* ("Work of the Afghan Boundary Commission and our new frontier with Afghanistan"): Tiflis, 1888.

extending from Zulfikar, on the Tedjend, on the west, to Khoja-Saleh, on the Amu-daria, at the north-eastern extremity of the line; and it was on the basis of these surveys that maps were drawn, and a line of frontier pillars afterwards erected.

The country along which the new frontier runs is in many respects different from other parts of the Trans-Caspian region. The northern outliers of the Paropamisus range from the Tedjend eastwards (known as the Barkhut, Chengurek, Bend-i-gandau, and Tirbend-i-Turkestan), as they gradually slope towards the north, form a plateau about 100 miles wide, which gradually changes into sandy plain extending as far as the Amu-daria. The southern border of this plain may be approximately defined by a line run from Sarakhs through Sari-yazi (on the Murghab) to Jelaur on the Ab-i-Andkhoi. Through this plateau the systems of three rivers cut deep channels as they flow from south to north; these are the Heri-rud, or Tedjend, the Murghab, with its tributaries the Kushk, Keshan, and Kaisor, and the Ab-i-Andkhoi (or Shirin Tagau), with its affluents. The surface of this plateau, especially in its eastern part, is heavily undulating, and covered with a number of clayey-sand hillocks. The ground is hard, but everywhere undermined with an endless number of rat-burrows, which make it exceedingly difficult to ride over, except on the beaten tracks of camels. Between the Tedjend and the Kushk, and on the right bank of the former, there are several small sand ridges, having a general north-westerly direction. Here the hillocks are higher, and their slopes frequently form hollows which contain the dry beds of salt lakes. Vegetation is generally uniform and poor. Near the Tedjend there are occasional pistachio trees and copses, but for the most part these sand hillocks are covered with assafœtida, and it is only in the valleys that there is a growth of bushes.

From the Murghab eastwards the relief of the country becomes much less marked, only occasional ridges may be seen, and the whole tract is covered with sand hills of nearly equal height, preserving the same general direction as the higher mountains, viz. from south to north. Between them are what are called "shors" by the natives—*i.e.* hollows filled during the rainy season with saline mud.

The highest points of this plateau are near the Tedjend about Zulfikar, 2700 feet; Dengli-tagh, 2700 feet; the left bank of the Kushk near Kara-tepeh, 3200 feet; the range between Keshan and Kushk, 3050 feet; the head-waters of the Kaisor near Sofi, 3900 feet; and the Karabel plateau, 4000 feet.

The whole plateau affords excellent pasturage. In March, after the rainy season, it is covered with fresh, green herbage, which in April, after the rains, is parched up by the nearly vertical rays of the sun, and the whole tract becomes a wilderness. Towards the sand plain vegetation becomes scarcer, and only the oasis of Andkhoi, with its gardens, relieves the dreary monotony of the landscape, which further towards the Amu-daria becomes changed into drift sands, covered with occasional scrub bushes.

The arable lands are limited to the valleys of the rivers, and depend entirely on the quantity of water available for irrigation in each river.

In the province of Maimana, however, the spring rains continue till May, and rain crops are raised in the ravines leading into the river valleys.

Of all the rivers we have mentioned, the Murghab is the only one which does not dry up and has plenty of water all the year round. The others are only well watered in spring, and towards the end of the summer they dry up. But such is the rapidity of growth, that even this brief period is sufficient to raise crops which are harvested in June, or not later than July, so that by the time the water has fallen in the rivers the need for it ceases.

The central course of the Tedjend between Zulfikar and Sarakhs forms the boundary between Persia and Russia. Along this tract on the Russian side agriculture is only possible around Sarakhs, as the right bank of the Tedjend is mostly steep and precipitous, and does not admit of irrigation canals. The valleys of the Kushk, Keshan, Murghab, and Kaisor, are more favourably situated in this respect. These valleys are about a mile to a mile and a half in breadth, while the rivers are only 10 to 25 yards wide, except the Murghab, which is about 50 to 60 yards wide. In these valleys the whole agricultural industry has been in the hands of the Jemshidi, the Salors, and Saryks—the inhabitants of Penjdeh. During the last twenty-seven years the Saryks have monopolised this region, while the head-waters of the Kushk, as high as Bala Murghab, are in the hands of the Jemshidi, and the sources of the Kaisor in those of the Uzbeks.

The Ab-i-Andkhoi waters the Andkhoi oasis, in the centre of which is the town of the same name, surrounded by gardens and cultivated land. North of it, and the nearer we approach the Amu-daria, the scarcer becomes the vegetation, till suddenly the whole aspect changes as the grand river of Central Asia opens before us with its wide belt of gardens and fruitful land on either bank.

MAGNETIC OBSERVATIONS in 1885-86, by Colonel P. P. KUHLBERG, at Shemakha, and along the Afghan frontier.

PLACE.	Latitude, North.	Longitude East of Greenwich.	Variation. East increasing.	Dip.	Horizontal intensity in Milligrams.
Shemakha, . . .	40° 36·8	48° 39·0	1° 45·6	54° 33·5	2·6502
Zulfikar, ...	35 34·9	61 16·2	3 10·4	49 10·0	3·0141
Meruchak, . . .	35 51·8	63 5·2	{ 3 13·5 / 3 14·4 }	49 16·1	3·0007
Charshambe, . .	35 44·9	63 59·0	3 34·3	49 9·0	3·0189
Dowlet-abad, . .	36 27·9	64 53·2	3 51·2	{ 50 4·0 / 50 0·0 }	2·9937
Andkhoi, . . .	36 54·5	65 6·7	4 2·6	50 47·2	2·9653
Bosaga, ...	36 32·3	65 44·9	4 19·8	51 45·5	2·8806
Palvart, ...	38 11·2	64 34·3	4 2·7	52 31·4	2·8774
Charjui, ...	39 1·3	63 35·4	3 51·8	53 30·5	2·8439

NOTE.—The astronomical observations for latitude and longitude are by Gedenof, the magnetic by Kuhlberg. Of the latter, those at Themakha were made in October 1883, the rest between November 1885 and September 1886.

NOTE ON THE DISTRIBUTION OF TRADE-CENTRES.

By Arthur Silva White, F.R.S.E.

Secretary, Royal Scottish Geographical Society.

(With a Map.)

The relationship between trade-routes and distributing centres is a subject of the highest importance, not only to our merchants, but also, and in a greater degree, to the statesmen who direct and control the colonial and foreign affairs of this country. That this relationship is of the most intimate kind, and the result of a natural law which has been evident since the days when the early civilisations of China, India, Arabia, and the Mediterranean were first evolved, is a well-marked historical fact. Sir Charles Wilson, in his recent address at Bath as the President of the Geographical Section of the British Association, entered at some length into the discussion of this theme. Having directed attention to the influence which the natural features of the earth's surface had had, and were still having, in conjunction with other causes, on the trade-routes and commercial relations between the West and the East, Sir Charles Wilson explained how that, in our own day, we were "experiencing the results of a natural law that a redistribution of the centres of trade must follow a re-arrangement of the channels of commerce." That this law has operated in past times we have ample evidence in the cases which he cited. To go no further back than the opening of the Suez Canal, now nearly twenty years ago, we are still experiencing the results, not favourable to ourselves, of the deflection of commerce from the Cape route to that by the Mediterranean and Suez Canal: instead of London being the chief distributing centre of the riches of the Far East, as in earlier times, there have arisen in the Mediterranean basin a number of competitive centres. The Mediterranean Powers thus enjoy a partial revival of their ancient prosperity. To Great Britain, as the chief possessor of the sea-borne trade of the world, this is a serious commercial loss, and it is only by seeking compensation elsewhere—*e.g.* in the acquisition of new markets—that her merchants can hope to retain their paramount advantages. Unfortunately a new and inferior type of vessel, specially constructed for the Canal service, has sprung into existence, and it is a type not at all adapted to the great ocean routes.

To those of our readers who desire to acquaint themselves with the historical development of trade-routes, and their intimate connection with geography, I may mention that Dr. Hugh Robert Mill has provided, in his article on "The Relations between Commerce and Geography" (*Scottish Geographical Magazine*, vol. iii. page 626, *et seq.*), an instructive summary, and the back numbers of the Magazine afford ample material for closer study. In this note I do not, therefore, propose to attempt even a bare outline of the subject, the comprehensiveness of which would require a series of articles to portray.

The map accompanying this paper may, however, be studied with advantage, and I shall briefly allude to some of the leading facts it is intended to illustrate. We issue it mainly as an introduction to

a series of papers we hope subsequently to secure from specialists on the chief aspects of Commercial Geography. If this new-born science is to teach us anything and justify its existence as a separate branch of Geography, it must inform our merchants of the distribution of the products of the earth, the best routes by which to carry them, and the means by which they may most profitably be turned to account, of new markets and how to exploit them, of old markets and how to develop them. Our map should be studied like a game of chess, or as Prince Bismarck is reputed to study the playboard of politics; and it should suggest to the skilled player possibilities which his own individual genius may realise. If our merchants are deficient in geographical knowledge, they cannot hope to compete against those who (like the Germans, let us say) are better equipped by their scientific training in this direction to engage in the pursuit of commerce. The good old buccaneering days are over, and there are no more continents to discover (if we except the unprofitable Antarctica). The earth is now almost thoroughly explored, and its treasures are daily being exploited; but there still remain new markets to discover, and old markets to develop —not in the haphazard, privateering style of bygone times, but in the light of scientific commercial geography.

Of old markets, for instance, there are the unfathomed and almost illimitable possibilities of China and the Far East—markets which for so long have been almost exclusively in our hands, yet owing to the recent *rapprochement* of China to Western civilisation and methods of action, still open out the prospect of what may practically be considered a new field. In Manchuria, Mongolia, and Chinese Turkestan, there are immense tracts of country where Western commerce has never yet entered; then there are Indo-China or Further India, with Burma, Siam, the Shan States, and the Malay Peninsula, offering new markets waiting to be developed; and there are the interiors of Borneo and New Guinea, of the resources of which next to nothing has been ascertained. Our access to the treaty-ports of China, our friendly and increasingly intimate relationship with this great Power, and our commercial stronghold at Hong-Kong, place us in a peculiarly advantageous position for the purposes of commerce. British Burma, too, when once it is pacified and connected with India and China by a system of railways, will afford a splendid centre of commercial operations, from which Yunnan and the markets of Eastern Asia can most easily be reached. Instead, also, of tapping Tibet by the circuitous route *via* Katmandu, in Nepal, we may hope some day to establish a safe highway through Sikkim. The markets of Eastern Asia will thus have the advantage of a base of operations in British territory. On the other hand, it must not be forgotten that, with the improved facilities of communication which sooner or later will of necessity be introduced, the creation of new and active centres of trade will profoundly modify the prosperity of existing commercial towns.

Mr. Kenric Murray, in his recent treatise on *Commercial Geography*, assures us that the trade of India, the fifth great commercial Power of the world, has increased tenfold within the last fifty years, and this may be ascribed to the fact that, in the case of India, we study the tastes

and requirements of our customers. In Eastern Asia, on the contrary, whether from ignorance or not, this, the first essential in successful foreign trade, has not been sufficiently observed; hence a decline in certain directions where there should have been an increase, and the greater success of foreigners who have pursued a more enlightened policy.

The rich markets of Central Asia and the undeveloped marts of Siberia will undoubtedly acquire an increased importance when the Russian railway across Siberia has been constructed; but, on the other hand, its terminus at Vladivostok, on the Sea of Japan, will be perhaps as powerful a focus for commerce as the Pacific terminus, at Vancouver, of the Canadian Pacific Railway. Besides increasing her resources as a maritime Power, Russia will thus be enabled to treat with China on a new and more advantageous footing. The importance of Vladivostok, from a strategic as well as from a commercial point of view, has, however, long been known: hence the apparent unanimity in ascribing to Russia, in her great scheme of connecting by railway St. Petersburg with the Pacific, not the motive of developing the resources of her Asiatic possessions, but the strategic necessity of a military base on the Pacific which is not so dependent on maritime ascendency. General Annenkoff and the Government of the Tsar may be trusted to push forward the work on this great transcontinental railway, but many years must elapse before it can hope to compete, as a commercial highway, against the Canadian Pacific Railway, which is already in full working order, and has secured a good start by establishing regular steamer communication from its Pacific terminus to the Far East and Australasia. The proposed route of the Russian Pacific Railway is indicated on our map; and it will be seen that the water-communications of Siberia will at first be utilised. The rivers which would have to be crossed (or eventually bridged) are the Tobol at Tobolsk, the Irtish at Omsk, the Obi to the west of Tomsk, the Tom at Tomsk, the Yenisei at Krasnoiarsk, and other less important streams. Lake Baikal might also be utilised in the same way, in order to avoid a detour which the railway would have to make of 124 miles round its southern shore. The alternation of railway and water communication will, therefore, detract from the value of this route for commercial traffic until a continuous line of rails has been laid; and it must be many years before such can be accomplished. Fortunately, for the promoters of the scheme, no great difficulties from differences of elevation will have to be encountered.

Turning to Africa, we have at the Cape, by reason of our recent annexation of Bechuanaland and the fact of our sphere of influence having been advanced to the banks of the Zambesi, a completely new field of commercial enterprise which, apart from the mineral riches of the country, offers a series of new markets to British capitalists. In our frontier post of Kimberley, situated in a healthy country, we possess a trade-base which even now is the terminus of a system of railways; and the importance of Shoshong, in Bechuanaland, as our most advanced trade-centre is daily increasing. Central Africa is a virgin country which, unlike the other markets mentioned, will require years of exploitation and development to open up to extensive trade; its teeming population has not yet the purchasing-power to command it. On the

other hand, it is scarcely necessary for me to mention that the boundless possibilities of Central Africa are fully recognised, and the capital invested in its development is already very considerable. The European Powers established on the sea-board show, at least, from their anxiety to annex all unappropriated territories, that some commercial profit is eventually to be obtained from the possession of African lands. If the rich states of the Mohammedan Sudan are the monopoly of the Royal Niger Company there is not wanting a keen rivalry on the part of the French and Germans to acquire a portion of it. On the East Coast the Imperial British East African Company has secured an admirable base from which to tap the basin of the Upper Nile, and possesses within its own territory soils adapted to wheat-growing that have the advantage of being nearer home than are those of India.

In the New World, we have our most extensive colony, the Dominion of Canada, nearly equal in area to Europe, where vast lands are waiting for the settler. The great North-West, owing chiefly to the Canadian Pacific Railway, offers a most promising field, although the new routes now being projected on all sides must be regarded, not as trade routes in the proper sense of that term, but as channels for capital and energy which in time may develop into natural outlets for commercial activities. Whether Central America and the Western States of South America are likely to feel the impulse to commerce which the cutting of the Panama isthmus is sure to produce at some distant day, is a point not calling for prophecy; but if ever the canal is thrown open without locks, all the ports on the western shores of North and South America will, by being thus brought nearer to Europe, enjoy the advantages to commerce which arise out of the relative proximity of centres of distribution. The disregarded markets of South America, and the large areas of unexplored lands, mostly afforested, are patiently awaiting the advent of European capital and energy to explore and develop them. However, Dr. Mill points out to me that the opening of the canal may handicap British freights to San Francisco as compared with cargoes from the Eastern States of the Union. At present, he explains, the distance from New York to San Francisco by Cape Horn is 15,900 miles, and from Liverpool 16,900 miles, or 6 per cent. further; but when the canal is opened New York will be 4200 miles from San Francisco, and Liverpool 8200 miles, or no less than 96 per cent. further; thus practically *doubling* the distance of Europe as compared with the Atlantic States from the Pacific coast.

Mr. J. G. Bartholomew has introduced some original features into the map he has prepared for us. Although scarcely requiring interpretation, attention may be directed to one or two points it is designed to illustrate The main routes or channels of commerce are clearly marked; a comparison between alternative routes may therefore be made. Only towns having some claim to be commercial or distributing centres have been included, though no attempt has been made to distinguish between their relative importance. The principal products of each country are mentioned. Projected through-routes by sea and land are indicated by dotted lines; only the more important are given, but these are sufficient to prognosticate the approaching re-distribution of the centres of trade, more

especially on the Pacific. An attempt has been made to delimit the sea and land areas open to commercial intercourse (1) throughout the year and (2) in the summer months only. Waste lands—such as deserts, tundras, etc.—are left blank; and the Palæocrystic seas, as well as the seas the free navigation of which is obstructed by ice, thereby practically precluding or greatly restricting the operations of commerce, are also delineated: thus narrowing the known World, properly so called, to its true and practical limits. Though profit may be extracted in one way or another from nearly all these ostracised regions, their products do not entitle them to a position among the commodities of international commerce, with which we are at present only concerned. The data employed in the construction of the map are, as yet, imperfect in some respects, but sufficiently accurate to bear out at least the general aspects of the subject they are intended to illustrate. Our chief object has been to direct the attention of our readers to the regions of the World open to, or available for, commerce, in connection with the existing and projected International Highways.

I append a bibliography of the chief articles bearing more or less directly on the subject which have been published in the Magazine, to which reference should be made. Those marked with asterisks have illustrative maps. The *Geographical Notes* supplying similar information are too numerous to mention.

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A COMMERCIAL CHART
THE WORLD
SHOWING APPROXIMATELY
THE REGIONS OPEN TO AND AVAILABLE FOR
COMMERCIAL ENTERPRISE
TOGETHER WITH THE EXISTING AND PROJECTED
INTERNATIONAL HIGHWAYS
EXPLANATION AND REFERENCES
Regions at present engaged in International Commerce
Regions capable of Commercial Development but at present undeveloped
Regions open to Commerce at all seasons only during Summer months
Barren and Desert Regions incapable of Commercial Development
EUROPE
ASIA
AFRICA
NORTH AMERICA
SOUTH AMERICA
AUSTRALIA
OCEANIA
GREENLAND
DOMINION OF CANADA

THE KERMADEC ISLANDS.

By John Gunn, F.R.G.S.,

"Challenger" Expedition Commission.

The report[1] on the capabilities and extent of the Kermadec Islands from the pen of Mr. S. Percy Smith, Assistant Surveyor-General, Auckland, contains much that is interesting and useful, and does for this small group what is much needed for all the less known islands of the Pacific. The author spent but a fortnight in his survey; a period, however, quite long enough to enable him to note much of interest, and to bring together material for a thorough and most readable account of what he had seen and learned during his sojourn.

There appears to be some doubt as to who was the real discoverer of the Kermadec Islands, the generally received statement being to the effect that they were first sighted by Lieutenant Watts of the *Lady Penrhyn* transport; indeed, in the Admiralty Sailing Directions it is recorded that "the two southern islands of the Kermadec group, Curtis and Macauley islands, were discovered by Lieutenant Watts of the *Penrhyn* in 1788."[2] Nevertheless, it would appear from Watts' own journal that, although the *Lady Penrhyn* was under his command when she left England, he was superseded by Captain Severs, who had charge of the vessel when the islands were sighted for the first time. The discovery of Raoul, or Sunday Island and L'Esperance Rock, is due to D'Entrecasteaux in 1793, and three years later the British ship *Britannia*, Mr. Raven, master, visited the group, after which date Raoul became a recognised port of call, or "ocean post office," for the numerous whalers then plying a successful trade in the South Pacific. D'Urville landed on the islands in 1827. In 1837 two men, named Baker and Reid, settled here with their families, but did not permanently occupy their settlement. In 1840 some Americans found their way to the group, and during the same year Commdore Wilkes brought the ships of his famous exploring expedition to anchor off the coasts. The next visitor of importance was Captain Denham of H.M.S. *Herald*, who made a survey of the group which occupied three weeks. H.M.S. *Challenger* passed through the islands in 1874, but none of the naturalists landed, the only noteworthy result of this part of her voyage being a single deep-sea sounding. In 1876, Captain Berger, of the *Vibelia*, was deserted by his ship's company, and left for a time on the islands, and, during the same year, Dr. Stockwell, a New Zealand naturalist, made a short stay. In 1878, Mr. Bell and his family formed what promises to be a permanent settlement in the Kermadec group, and the measure of success which has attended his experiment will be alluded to further on. Besides what has already been mentioned, various small and unsatisfactory attempts at colonisation, or rather squatting, have been made there from time to time, but volcanic disturbances or visits from

[1] *The Kermadec Islands: their Capabilities and Extent.* By S. Percy Smith. Wellington, 1887.

[2] *Pacific Islands*, vol. ii. (Central Groups), 1885, p. 5.

distressed slavers, with consequent spread of disease, served to frighten away those who had gone through some fatigue and hardship in the attempt to make themselves a home on the islands.

Having thus briefly sketched the history of the islands, particulars of the group are added below, the information being taken from Mr. Smith's admirable report.

The positions of the islands are as follows :—

	Lat. S.	Long. W.
Raoul, or Sunday Island,	20° 15′ 30″	177° 54′ 50″
Macauley Island, .	30° 15′ 0″	178° 32′ 0″
Curtis Island, . .	30° 35′ 0″	178° 36′ 0″
L'Esperance Rock, .	31° 36′ 0″	178° 55″ 0″

The extremes of the group are 142 sea-miles apart, 68 sea-miles separating Raoul from Sunday Island, Curtis Island being 22 sea-miles from Macauley Island, and L'Esperance Rock 52 sea-miles from Curtis Island. Sunday Island is exactly 600 sea-miles distant from Auckland.

The Kermadec Islands appear to be situated on the ocean plateau which runs out from New Zealand towards the Tonga Islands, upon which soundings are got which, although at great depths, are comparatively insignificent when compared with those recorded on either side. As the formation of the islands is plutonic, it would appear that they are volcanic peaks rising far above the level of the plateau on which they are situated. Between Sunday and Macauley Islands a depth of 660 fathoms has been obtained ; and 40 miles north of the former there are 600 fathoms. The group lies within the zone of volcanic activity embracing the Bay of Plenty and the Tonga group, where there is much seismic activity, and on the Kermadec Islands, earthquake shocks and volcanic outbursts are frequent. Since the settlement of Mr. Bell several disturbances have been experienced, notably one on 5th April, 1881, but nothing of an alarming nature has been noted since 1886. In 1872 one of the most serious outbursts known to have occurred here took place, when the crater on Raoul had a thick covering of mud, rocks, and pumice scattered over it, and an island rose up out of the waters of Denham Bay, only to sink again after a time like the famous Graham's Island of the Mediterranean. The Wolverine Rock, perhaps, formed the core of this island, which assumed the form of a sand mountain and was gradually washed down until it became a shoal. The Wolverine Rock was not noticed by Captain Denham, and as the water continually breaks upon it, there can be little doubt that it has appeared since his excellent survey was finished.

In winter the winds are south-west and westerly, and north-east and easterly in summer—not trade-winds but "variables," resembling those experienced north of New Zealand. In winter, it would appear, there are almost constant strong breezes. Hurricanes are recorded by Mr. Bell as having occurred in January 1879 and February 1880. The rainfall is copious but not excessive, and the temperature, although slightly higher, closely approximates to that of northern New Zealand. Frosts are unknown.

Sunday Island is triangular in shape, 20 miles in circumference, and

has an area of 7200 acres. Its highest point is Moumouki, 1723 feet above sea-level. The surface is rugged and broken, most part being covered with forests. The great crater occupies a position to the north centre of the island, its walls varying in height from 180 to 1700 feet, with ridges running down from the rim to the coast, and terminating in bluffs and cliffs frequently 1000 feet in height. These ridges are deeply scored with ravines and gullies, but, notwithstanding, there is a considerable area of ground not too steep for cultivation, but level land is almost entirely wanting. Along the shores of Denham Bay there is a flat about a mile and three-quarters broad, and with an average width of 10 chains, containing in all about a couple of hundred acres, one-third of which had been formerly under cultivation, but is now abandoned to the pigs and goats, and is so overgrown by heliotrope as to be well-nigh irreclaimable. Pohutukawa and ugaio trees are also beginning to shoot up along the borders of this space, and promise soon to cover what was lately an area usefully employed to sustain the workers who had brought it under cultivation. On the north coast, near Fleetwood Bluff, Mr. Bell's fields are situated on a plateau 200 feet high, containing about 200 acres of rich soil, but only a part has yet been reclaimed. Another flat space of nearly 90 acres lies to the east, but cannot be yet turned to profitable account, as it is covered with some wood and pumice from one of the last volcanic outbursts. These parcels of land, and a slope of 30 acres near East Bay, and a valley of between 50 and 60 acres near Boat Cove, exhaust the list of ground capable of being turned to agricultural use. The bottom of the crater is also flat, but eruptions have rendered it incapable of sustaining plant life for years to come. There are two lakes in this hollow, the smaller of which was the scene of volcanic activity in 1872, when great quantities of pumice, stones, sand, and mud were ejected, covering the ground to a depth of, in some cases, 12 feet. Some of the lighter fragments of *débris* were thrown out over the rim of the great crater, destroying all the forests within the compass of their fall, while to the north-west a thinner film of deposit covers the hills. But desolation does not reign supreme within the crater, for signs of vegetation are seen in the shape of pohutukawa, ugaio, tutu, and other shrubs, clumps of which have already covered much of the *débris*. Before the eruption, pohutukawa and uikau-palms flourished here in rich clumps, the soil being exceedingly rich and well calculated for raising all kinds of crops. Green Lake is a miniature crater, with steam escaping from the sides, but the water it contains is cold. Steam also rises from fissures in the steep cliffs of Denham Bay, and warm water oozes through the sands of the northern part of the island at low tide. The soil of Sunday Island in general has been formed by the decomposition of pumiceous tuff and andesitic lava, with an intimate mixture of good vegetable mould; it is of exceeding richness, has not been wasted by fire, as is so often the case in New Zealand, and, in the opinion of Mr. Smith, is well fitted for raising all kinds of crops and plants allowed of by the latitude. The pumiceous tuffs being exceedingly porous, allow the quick percolation of the rainfall, and prevents its storage near the surface, thus reducing to a minimum the danger of landslips, should the forests at any future time

be cleared off the slopes to make way for settlers. Only one small running stream was observed; the gullies were all dry, but small pools of water rested in the hollows of the lava. There are three or four lakes of fresh water, but all, with one exception, appear to be useless for economic purposes.

The vegetation bears a strong resemblance to that of northern New Zealand. The forests appear to be valuable, the quantity of pohutukawa being so large as to be sufficient, for all the ship-building purposes for which it is used, to supply the New Zealand builders with all that can possibly be required for many years to come. Among the other trees and plants are the following:—Uikau-palm, mapou, whauwhau, karamu, ugaio, karaka, kawakawa, tutu, tree-ferns, corumbium, candlenut, a Dracæna, toe-toe, Cape gooseberry, arum, banana, taro, kumara, orange tree, lemons, citrons, and shaddocks, limes, custard, rose, and mamee apples, yellow guava, pomegranates, yams, melons, the calabash, grapes, apples, pears, peaches, chestnuts, pineapples, mangoes, strawberries, Tonga-beans, sugar-cane, pea-nuts, beans, kapi, and maize, which, with all the more common vegetables, flourish vigorously.

Fish are plentiful, and of fine quality. Turtle were seen, but they do not appear to breed in the vicinity, the coral islands in warmer latitudes being selected by them for that purpose.

The land birds are not numerous; the tui, kingfisher, lark, paroquets, hawk, grey duck, and a pukeko were observed. Wild cats are very numerous, and have exterminated the pigeons and some other birds which were once common on the islands. The blight bird and two species of cockatoos are sometimes seen, and linnets and goldfinches are known to have visited the group upon one occasion, but have not returned. On Napier and Nugent Islands are breeding-places of the albatross, and on Meyer Islet of the gannet. September and October are the breeding months of the mutton bird, when the islands are resorted to by very great numbers, the young forming an important article of food among the settlers. The wide-awake gull and the tropic bird are also visitors, but the latter is rare.

Goats have been long introduced, thrive well, and are in great numbers. Merino sheep were brought from Otago by Mr. Bell, who now has a flock of about three hundred; they have young once in nine months, the ewes generally dropping twins. The increase would have been much more rapid were it not for the difficulty experienced as to a proper food supply, the European grasses sown by Mr. Bell being destroyed by caterpillars. *Poa pratensis*, however, is successfully propagated by division of the roots and hand setting; this must, doubtless, be a tedious process at best. Pigs run wild about Denham Bay, and are prevented from spreading over the island by the sheer cliffs surrounding on all sides the area occupied by them. The only indigenous animal is a grey rat, about five inches long; it is supposed to hibernate during the winter.

There are several landing-places on the island, but frequent surf makes them to be often impracticable for boats. Anchorage for larger vessels can be had almost anywhere on a good sandy bottom, and ships

may approach the land according to the wind; the best shelter appears to be had close under Meyer Island.

The Herald Islets are eight in number, and lie north-east of Sunday Island, being mostly bare rocks, the resort of gulls in the breeding season.

Meyer Island has an area of 30 acres, and attains a height of 485 feet, covered with bush on its west side. Mutton birds and green paroquets were numerous here at the time of Mr. Smith's visit. There is a good boat harbour. Goats, once common, appear to be now extinct.

Macauley Island is situated 68 miles south of Sunday Island, and has an area of 756 acres, being one mile and a quarter long by a mile in width. It is an extinct volcano, the highest point being 871 feet, generally descending seawards in a gentle slope, cut up by shallow gullies, the whole clothed with fine smooth grass. The soil is a dark volcanic loam, and appears well suited for agricultural purposes. Cliffs rise from the sea on all sides, varying in height from 200 to 600 feet in height. Landing may be got under the shelter of Hasgard Islet, and the cliffs scaled by means of a rude natural staircase formed by an outflow of andesitic lava. Besides the grasses, which are of close growing varieties, there are a few ferns, and some small corumbium and ugaio bushes; traces remain of a former bush growth of a larger kind. Goats are rather numerous, but seem at present to have their increase retarded by the presence of a dog. As the dog could not live without a constant water supply, it may be taken that such exists, although nothing of the kind was observed except a few pools in the lava hollows, which may have been caused by the rain which fell a few days before Mr. Smith's visit. Fish, crabs, and limpets, may be obtained in almost any quantity.

A dangerous rock, not marked on the charts, but known as MacDonald Rock, lies N. $\frac{1}{4}$ W., distant two miles off the highest part of the island, and appears to have 6 to 8 feet of water on it; fifteen fathoms were got two cable-lengths to the west of it. All other dangers appear to be visible. There are 10 to 15 feet in the passage between Macauley and Hasgard Islands, and anchorage may be had in 18 fathoms about half a mile off the lava staircase. Hawks, blight-birds, and green paroquets were seen here.

Curtis Islands consist of a couple of rocky islets, lying 22 miles off Macauley Island. The channel separating them has a depth of 15 fathoms, free from dangers. There is here an active crater, although its forces seem now well nigh exhausted; steam, however, is still let off in some quantity, with pools of boiling mud and water in the bottom. Small quantities of sulphur are found on the island. The only green thing is the ice-plant, which vainly tries in isolated patches, to hide the naked rock. The smaller island, named by Mr. Smith, Cheeseman Island, is still more barren and desolate looking than the other, and is a breeding-place of sea-birds.

L'Esperance, sometimes known as Brind, or French Rock, lies 52 miles S. $\frac{1}{2}$ W. (mag.) from Curtis Islands. It is a mere bare rock, 250 feet high, and as many yards long. The huge rollers dashing against its

sides prevented Mr. Smith from making any attempt to land, but he judged that the rocks, dark brown in colour with occasional reddish patches, might be scoriaceous lava. The ice-plant grows on the more level portions of the islet, and terns dot the cliffs and float on the surrounding sea.

The Havre Rock lies 10 miles NNW., and is just a wash.

In conclusion, Mr. Smith strongly urges the New Zealand Government to provide huts and provisions on both Sunday and Macauley Islands for the use of shipwrecked crews, and recommends a yearly visit from a steamer. He also suggests that a few trees be planted on Macauley Island, and, perhaps, on Curtis Island. He looks forward to the Kermadec group forming, at some future time, a suitable outlet for the surplus population of New Zealand, a purpose for which it appears to be admirably adapted.

GEOGRAPHICAL NOTES.

EUROPE.

M. Jules Meurer on the Alps.—This well-known Alpine climber has published in the *Oesterreich. Touristenztg.* (No. 13, 1888) a list of heights for some of the highest peaks in the Austrian Alps. These heights, which are derived from measurements made during the last few years by the Royal and Imperial Military Geographical Institute, do not, as a rule, differ in any marked degree from those accepted before, and in many cases these slight differences may be due to the varying depth of the snow and ice on the summits. In a few cases, however, important alterations have been made, as may be seen from the following figures: the Pallon della Mare, 12,156 feet (formerly 12,415 feet); Punta di San Matteo, 12,113 feet (formerly 11,919 feet); Monte Giumella, 11,808 feet (formerly 11,608 feet). The greatest alterations are found in the Dolomites, the culminating point of which, Marmolata, must be lowered from 11,464 feet to 11,019 feet, though it still remains the highest elevation. During the present year the heights of the Hohen Tauern and of the Oetzthaler Alps in the Tyrol are being investigated.

M. Meurer also proposes, in the *Deutsche Rundschau* for September, a scheme for dividing the Alps into groups. In deference to popular usage, he divides them into Eastern and Western Alps, drawing his boundary line from the Lake of Constance along the Rhine to the Via Mala and over the Splugen or Bernadina Pass into Italy. The Graian, Cottian, and Maritime Alps form a third division to be called the Southern Alps. Their northern limit runs from Chambery along the valley of the Isère, over the Little St. Bernard, and down the valley of Aosta. This is intended only as a primary division, further sub-division being postponed until more unanimity is displayed on Alpine questions.

The Physique of the Swiss as influenced by Race and by Media.—Dr. Beddoe F.R.S., read a paper on this subject at the British Association meeting at Bath, of which the following is an abstract:—The paper was founded on the official recruiting returns. The average stature of Swiss recruits (including the rejected) between the ages of nineteen and twenty is 163·5 cms., or 64·3 inches; the full-

grown stature is perhaps nearly an inch higher. It is greater, generally speaking, in the districts where French or Romansch is spoken than where the language is Italian or German. From the point of view of race it is highest in the Helveto-Burgundian area, *i.e.* the Jura, contiguous to the French department of the Doubs, where the stature is the highest in France, lowest in the Kelto-Alemannic area, especially around Appenzell, and in the Oberland. Weaving and embroidery, which are the chief occupations about Appenzell, St. Gall, etc., may be blamed as productive of degeneration, but watchmaking, in the Jura, does not seem to be so ; and the low position of the Oberland, which extends to other points besides stature, is difficult to explain. Goître seems to have a geological distribution ; myopia belongs to the towns, to the highly-educated, to the Germans (readers of German type), to the lacemakers and embroiderers. On the whole, the physical development is healthiest in Nidwalden and Tessin, and it is mentioned by the Swiss officials that the diet in these two cantons consists largely of cheese.

Novaia Semlia.—M. K. Nossilof, a Russian, has spent twelve months in exploring this twin-island, and has returned to Archangel with valuable botanical, mineral, and zoological collections. He reports the discovery of four coal-fields and deposits of iron, copper, gold, and sulphur, some of which he asserts would pay for the working. He has also collected information regarding the animal life of the islands, recorded a large number of meteorological observations, and surveyed a large extent of country. While engaged in tracing the coast line, he discovered three new islands, one of which (about 19 miles long and 3 broad) he named Possiet Island. M. Nossilof intends to devote five years to the exploration of Novaia Semlia, and will continue the soundings in the Kara Sea, which he has already commenced, as far as the Yenisei River.—*Globus*, No. 12, 1888.

ASIA.

The Languages of the Zarafshan Valley.—Two groups of people inhabit the Zarafshan valley, the one speaking Túrki languages, the other Persian. The latter are called Tájik, and dwell principally in towns, finding occupation in commerce and handicrafts. Their chief seats are Khojend and Samarkand. Their language probably differs little from the written Persian. There are four Túrki languages spoken : Kirghíz, the Kara-Kalpak, the Turkoman, and the Jagatai or Uzbek. The last only is a literary language, and differs considerably from the other three. The Uzbek are by far the larger portion of the inhabitants of the Zarafshan valley.

The language is purest where fewest strangers have settled, and therefore the Kirghíz spoken on the steppes ranks first in purity, Kara-Kalpak and the Turkoman of the Nurata mountains coming next. In the Zarafshan valley many Arabic and Persian expressions are used. As soon as an Uzbek acquires a little education, he applies himself to the study of Persian and Arabic. Official documents are always written in Persian. The result is that the Uzbek are heavy in their conversation, and devoid of expression, through their endeavour to make use of a language which they do not thoroughly understand.—*Abstract of a Note, by Dr. Cust, in the Journal of the Royal Asiatic Society, July* 1888.

The Volcanic Eruption in Japan.—About a hundred miles north-west of Tokio, in latitude 37° 36′ N., and longitude 140° 6′ E., stands the mountain Bantaisan,

or Bandaisan. On the 15th of last July this was the scene of one of the most appalling volcanic eruptions ever recorded, from the accounts of which in *Science* of 14th September, and in the *Times* of 11th September, we make the following brief note. The mountain is said to have been formed by an eruption in the year 807, but no account is extant of any eruption of the mountain itself, and an ancient writer asserts that its activity ceased when the lake Inawashiro, four and a half miles distant, was formed. The mountain, however, lies on one of the four lines which form the volcanic system of Japan; it is composed of scoriaceous matter, and bears on its summit the well-defined outline of an extinct crater. Moreover, the hot sulphur springs, which emerged from its sides in three different places, were evidence of existing volcanic energy. But trees grew high up on the sides of the mountain, and no display of volcanic agency had occurred in the neighbourhood for more than a century, so that the peasants, who dwelt in the neighbourhood, did not anticipate danger. On the morning of July 15th they were alarmed by rumbling sounds and shocks of earthquake, followed by showers of ashes, which caused a thick darkness, lighted up occasionally by flashes of fire. The lower of the two summits of Bantaisan, called Sho-Bantaisan, was blown into the air, and a crater little less than five miles in diameter was formed on its site. From this crater streams of mud, stones, boiling water, and ashes were poured over the country, destroying the crops, overwhelming villages, and swallowing up a large number of people. No less destructive were the earthquakes and whirlwinds which accompanied the eruption. Forests and houses were destroyed by them, and many deaths were due to these forces. The first accounts of such events are rarely very trustworthy as regards the numbers given, but there can be little doubt that this eruption is one of the most noteworthy. The loss of life has been estimated at 600 souls. Professor Sekiya and other experts have been engaged in a scientific exploration of the scene of action.

Ceylon.—The following statistics regarding Ceylon are of interest, as showing the present distribution of agricultural produce, now that coffee no longer occupies its old position as the staple export of the island. The figures have been compiled by Mr. Ferguson, editor of the *Ceylon Handbook and Directory*, a fact sufficient to guarantee that they have been collected with the utmost care. The total area of 1963 plantations and planting properties held by Europeans amounts to 664,209 acres; total area of 1475 plantations in actual cultivation, 318,067 acres; total (approximate) area under tea, 182,914 acres; coffee (*Arabica*), 77,407 acres; coffee (*Liberica*), 916 acres; coco, 12,000 acres; cinchona (total number of trees over two years), 35,655,000; cardamoms, 4592. The full significance of the great increase in the tea export may be best seen by comparing the figures for several years. In 1880 the total shipments of tea reached 160,000 pounds. For the season 1886-87 it had increased to 12,013,686 pounds, and for 1887-88 (estimated), to 22,000,000 lbs. The prospects of all the other crops are said to be good, as well as for the coconut oil and fibre industries, now chiefly in the hands of Cingalese landowners. It is, however, rather startling to find that 346,142 acres of plantation land still remain out of cultivation,—a result of the fall in coffee as the staple export; it gives another lesson to planters, were any additional needed, of the folly of trusting entirely to the production of a single article of consumption.

The Nicobar Islands.—These islands have lately been surveyed by Lieutenant-Colonel Strahan, R.E., who had at his disposal, so as to finish the work as soon as possible, a couple of Government surveying vessels and a party of convicts,

the latter being employed in all the heavy unskilled labour that was required to be done. As only one season could be devoted to the survey, various proceedings usually undertaken by such expeditions had, from want of time, to be dispensed with. For instance, no triangulation was attempted, and the results must, therefore, be regarded as only approximate. The difficulties encountered by Colonel Strahan were often very great, and generally a considerable amount of danger and hard work had to be overcome before a successful landing on the islands could be made. There are altogether eight large and twelve small islands in the group, which has a total area of 426 square miles, and a population of 6000 persons. The Nicobars have formed a British possession since 1869, in which year it was found necessary to annex the islands in order to put down piracy, which had rendered that part of the Bay of Bengal unsafe to any but heavily armed vessels. In the course of the late survey it was found impossible, as a rule, to land direct from the boats on account of the heavy surf, outside which the boats had to be anchored, and the crews reached the shore either by wading or swimming—a mode of landing which proved very detrimental to the surveyors' instruments. Except when a heavy roller struck the shore the water was seldom more than four feet in depth ; but, when the landing process had to be gone through ten or twelve times a day, it was sufficient to cause great fatigue and discomfort. Colonel Strahan's boat was capsized among the breakers no less than five times in the course of the survey, but no loss of life was sustained by the party. The natural dangers of the coasts are much increased by the want of anything in the shape of reliable charts, so that vessels must lie well out from the shore, and much valuable time is consequently lost in the necessary boat voyages to and from the landing-places. The currents and strong tides form other sources of danger at sea, and on shore the natives of many of the islands are exceedingly hostile and savage. In the interior of Great Nicobar Island the "Shom Pen" tribe is noted, even among the other savages, for its cruelty and utter want of civilisation. In this island there are several rivers navigable for boats, one of which, the Galatea, was partially explored. The course of this river is very tortuous, the banks are clothed with dense and varied tropical vegetation, the principal plants observed being the tree-fern, cane, and bamboo, through which occasional glimpses of great mountains situated in the interior were obtained, cloud-capped, and clothed with forests to their summits. The great purity of the sea-water conduces to the growth of corals of such beauty of form and colour as can seldom be seen elsewhere. The climate proved to be quite as unhealthy as popular accounts declare it to be, and frequently as many as 70 per cent. of the surveyors were stricken down by fever. The rainfall, evenly distributed throughout the year, is about 100 inches. The thermometer marks little change in the temperature either by day or night, and remains pretty steadily between 80° and 85° Fah. in the shade. The people appear to be allied to the Malay race, and the men are strong, heavily built, resembling Europeans in physique, and of a reddish brown colour. They differ completely from their neighbours, the inhabitants of the Andaman Islands. Their extreme laziness appears natural, as all their wants are supplied by Nature without any trouble on their part, and famines, droughts, and wars are unknown. Like the Andamanese, they have a faculty for readily picking up languages, and many speak English and Hindustani with considerable fluency. Their currency consists of red cloth, rum, and castor-oil, the two latter, when mixed together, forming a favourite drink. They have begun to adopt English names; Colonel Strahan notices such as Adam Bede, Dandy Jem, Sweet William, and Captain London. Their head-gear claims much of their attention, and an old cocked hat or pith

helmet is looked upon as a most valuable gift or reward. Christianity has made no progress among them, and if they worship anything at all it appears to be the evil spirits, in order to keep them away as far as possible. It is stated that fifteen Danish missionaries laboured here for twenty years without making a single convert. They are so utterly torpid and lazy that Colonel Strahan found it a useless attempt to engage them to carry burdens, or even to point out paths and localities, but on several occasions they were got to act as pilots —the only assistance they could be induced to extend to the surveyors.

AFRICA.

Tunis.—Sir Lambert Playfair, H.M. Consul-General for Algeria and Tunis, in the paper which he read at the recent meeting of the British Association, on "Tunis since the French Protectorate," said that the system of government adopted is totally different from that of Algeria, which may be styled "*Colonisation de luxe*." No State assistance of any kind is given, not an immigrant has been imported, not an acre of Arab land has been confiscated, and the whole civil charges borne by France do not exceed £6000 a year. A very short time ago the interior of the country was practically a *terra incognita* ; now it is being rapidly opened out to European enterprise, and it promises soon to rival Algeria in what must always be the principal industry of North Africa, viticulture. Commerce also has increased in a notable degree, but the beautiful and characteristic arts of the country appear to be in a state of decadence.

The German Colony of Wito.—This territory, containing only about 530 square miles, was in 1885 ceded to the German *Colonialgesellschaft* by the Sultan Achmed of Wito. It is bounded on the west by the Magogoni, on the east by the Indian Ocean, on the north by a line running from the Mkonumbi Creek through the town of Wito to the Magogoni ; its southern boundary, fixed in 1886 by the agreement between the British, German, and Zanzibar Governments, is a line running from a point on the shore 650 paces east of Kipini to the Kirimando River above Kikoni, and thence along the canal Dumembamba (a corruption of Mtomembamba) to the mouth of the Condoni, so that a narrow strip of land between the colony and the Ozi River was assigned to the Sultan of Zanzibar, though the towns Kipini and Kau on the Osi were founded by the Sultan of Wito. The northern limit of the Sultan Achmed's territory was fixed by the same convention at the parallel of latitude passing through the northern point of the island of Kwaihu. The country, though containing no elevations of more than 260 feet, rises beyond the limits of the colony towards the west and north-west. It is covered with savannahs, woods of Dum palms intermixed with mimosa and prairie grass ; and mangrove swamps extend along the rivers and the creeks, which on the east side run into the channel separating Lamu from the mainland. The soil is, in general, fertile, though the grass is not so juicy as in the neighbouring Gallaland. There is little forest-land.

Sultan Achmed, though now confined to his room by elephantiasis, is held in high esteem by his subjects, and possesses great influence beyond his own territory. He is reputed to be avaricious and crafty in commercial affairs, whereby he has acquired a large property. He is, or pretends to be, a strict Mohammedan. The ruling class in Wito are Swaheli, most of whom followed Achmet from the island of Patta, whence he was driven by the Arabs before the German Protectorate was established. They are Mohammedans, and spend their time at the mosques or in paying visits, occasionally taking a walk to their fields, which are

worked by slaves. The latter, called Washensi (barbarians or heathen), belong to the different inland tribes; they live under a very mild form of slavery, marry as they please, and receive a piece of land to cultivate for their own benefit. The Sultan owns most of the slaves, but, when labour is needed, he hands over some of them to the large landowners. Besides these, some Gallas (Wapokomo) and slaves who have escaped from Zanzibar (Watuballi) live in Wito-land; in fact no one particular race preponderates in the population, the Swaheli themselves being half-breeds. The Kiswaheli spoken in Wito differs considerably both in word-formation and pronunciation from the Zanzibar dialect. The customs of the Swaheli are those of Mohammedans in general.

Cabinetmakers, smiths, tailors, and turners pursue their crafts in Wito; the work of the latter possesses considerable merit. Spinning and weaving are carried on in the islands. All the inhabitants of Wito are liable to military service at the call of the Sultan, who provides them with rifles. The Gallas and Waboni also serve in his army. In the territory of the German colony Arab soldiers are enlisted.

The climate of Wito-land cannot be defined in one word as healthy or unhealthy. The town of Wito, imbedded in dense forest which excludes the fresh breezes, with its narrow streets and bad drinking water, is very unhealthy, as also are those places which are in the neighbourhood of mangrove swamps; but sites for settlements, where the sanitary conditions are excellent, are to be found. The rainfall is abundant. The agricultural products of Wito are rice, maize, sorghum, sweet potatoes, beans, sugar-cane, bananas, pine-apples, and water-melons. Coconuts grow for some distance from the coast; mangoes grow and thrive without any attention, requiring only to be planted; sesame seed is ground in mills turned by camels, and the oil is pressed out. The yield of these crops, however, is not sufficient even for the wants of the inhabitants. The tobacco, if properly cultivated and prepared, would no doubt prove to be of good quality. Cotton and coffee would probably requite the labour of cultivation, and coconuts are a reliable source of profit after the first five years. There is at present some difficulty in obtaining a sufficient quantity of labour, the natives asking high wages for a very small amount of work. In many places this state of things tends to improve as time goes on. Meanwhile, slaves may be hired from the large landowners, often at a trifling cost.

A large branch of industry is the preparation of caoutchouc, which has hitherto been exported by Hindus to Zanzibar or to India. The Germans are now taking part in the trade. The other chief exports are ivory, ostrich feathers, skins, and horns.

Cattle suffer much from fever, owing chiefly to the neglect of the herdsmen. The grass, also, in Wito-land is hard and wanting in nutritive properties, and the Swaheli therefore send their herds to pasture among the Gallas. Sheep and goats are found everywhere, asses are used as beasts of burden, and camels to turn the oil-mills; lately, horses have been imported. All kinds of beasts of prey are found, also buffaloes, rhinoceroses, hippopotami, several kinds of antelopes, wild boars, and great quantities of feathered game. Steamers of the British India Line call every four weeks, anchoring off the island of Lamu.

Wito-land has often suffered from the attacks of the neighbouring Gallas and Somali. In 1887 the Somali made an incursion, and carried off large quantities of cattle. The Gallas have been considerably reduced in numbers in their wars with the Somali, but the latter people is still formidable and a constant source of danger to the colony.—*Lieutenant A. R. Schmidt in "Globus," Nos.* 9, 10, 11, 12; 1888.

Congo Independent State.—The territory of the State has, for administrative purposes, been divided into 11 districts, as follows :—

District.	Chief place.	District.	Chief place.
Banana . . .	Banana	Equator . . .	Equator
Boma . . .	Boma	Ubangi . . .	Bangala
Matadi . . .	Matadi	Stanley Falls . .	Stanley Falls
The Falls (Livingstone)	Lukunga	Aruwimi-Wellé . .	(?)
Stanley Pool . .	Leopoldville	Lualaba . . .	(?)
Kassai . . .	Luluaburg		

Le Mouvement Géographique, Sept. 9, 1888.

Historical Notes regarding the Bangala.—The *Globus* in a recent issue (No. 18 of vol. liii.) contains a paper from the pen of Curt. von François on the history of three important tribes of Western Africa,—the Bangala, the Lunda, and the Kioko. As these peoples are only now beginning to emerge from barbarism, and have, of course, no records or monuments of the past except the graves of their immediate ancestors, it may excite some wonder that they should have a history of which anything is known. The Portuguese indeed, who first opened up to the world a knowledge of these parts, possess official papers which give an account of the conflicts between their own early settlers and these tribes, but the author has not derived his information from these sources, but bases his narrative entirely on oral traditions which are current among the people themselves, and which were communicated to him by Germano and the interpreter Kunha, whose wife was a Bangala Negress. More than 300 years ago, according to these traditions, there reigned over the great kingdom of Lunda a sovereign who had two wicked sons, whom he, out of a prudent regard for the welfare of his subjects after his death, resolved to disinherit. He therefore, when he saw his end to be near, invested his daughter Lukokesha with the royal insignia, the mere wearing of which would give her in the eyes of the people a right to the throne, divine and indefeasible. On her father's demise she was accordingly, without demur, acknowledged as the lawful sovereign. Of her brothers, one came forward to proffer his homage, but the other, fearing her vengeance, fled. His name was Bangala-Kinguri, whence his adherents adopted Bangala as their common and distinctive appellation. They reached the borders of Angola at a time when the Portuguese were at war with the queen of the Ginga and the Pende, who inhabited the left bank of the Kuango. Bangala sided with the Portuguese. The queen was overthrown, and the Pende fled into the interior, where they founded a kingdom on the left bank of the Kassaï, which still subsists. Bangala, being rewarded with the Pende territory, ruled over it as a vassal of the Portuguese. For a while he ruled well, introducing among his subjects a variety of improvements, the knowledge of which he had acquired from his intercourse with the Portuguese. In particular he promoted the culture, on an extended scale, of maize, manioc, beans, and pulse. One day, the people found their fields, which were covered with an abundant harvest, devastated by elephants. Bangala forthwith prepared an expedition to pursue these animals, and twenty well-armed huntsmen followed their traces as far as the valley of the N'dalla-Mukongo. Here they found no elephants, but good water, a lovely country, and much tobacco, salt, and timber. It was a far more attractive region than that from which they had come; and on returning home they expatiated in rapturous terms on all its delights. Bangala hastened at once to establish himself in this earthly paradise. He was permitted to reach it, but

not to taste its joys. He had degenerated into a cruel bloodthirsty tyrant, and as soon as he entered the house which was to have been his palace, he was suffocated in manioc flour, which a band of conspirators poured down upon him through a hole which they had made in the roof. He was succeeded by his nephew Kulanjingo, who led his people still further eastward to a beautiful country, which belonged to Hamba, the chief of the Pende. Hamba surrendered this to the Bangala, who soon afterwards founded therein their new capital, which they called Kassandshe. The relations between the native inhabitants of the new territory and their foreign master soon became strained, and Kulanjingo therefore, to strengthen his position, entered into a close alliance with N'gongo of Libollo and Kalunga, a Bondo chief. This trio conspired against Hamba, and, at a ceremony which they had prepared, foully murdered him. They had placed his throne above the mouth of a deep pit, which was only slightly covered over, and as soon as he sat down upon it he at once sank down alive into his grave. The people were then informed that the existing law with regard to the succession to the throne was to be changed, and that, in future, members of the N'gongo, Kalunga, and Kulanjingo families were to reign in turn. Kulanjingo was to reign during his lifetime, N'gongo was to succeed him, and then, in due course, Kalunga. Kulanjingo maintained constant relations with the Portuguese, and paid them annually a small tribute of ivory, on account of which the Government sent traders into his country to establish a factory. For the protection of their warehouses the Portuguese built the Feira (market) in Kassanje, and garrisoned it with soldiers. After the murder of Hamba his adherents put themselves on the defensive. Wars followed, in which, notwithstanding the determination with which they fought, they were ultimately vanquished. Kulanjingo was then crowned, with the customary solemnities, and received the homage of all the chiefs, and even of Hamba's son. Since that time there have existed in Bangala a conservative and a revolutionary party, the latter of which aims to introduce the nephew-right of succession (*Neffenerbfolge*). After Kulanjingo, N'gongo followed, and after him, Kalunga-Kamassa, after whom, in course of time, the great Bumba mounted the throne. Bumba, wished to get rid of the Portuguese from the Feira, and so demanded from the resident Director a tribute of schnapps and tobacco. Bumba, being refused his demand, forbade his subjects to sell anything to the white men. About the same time, in the Bondo village of Ndalla-Kissua, a Portuguese was murdered, whereupon the Government sent Lieutenant Almeida with fifty men to call the Bondo chief to account for this crime. The Lieutenant received all that he demanded, even to the cattle ; but having lost his way on his journey homeward, turned back to demand once more the same tribute. On this occasion, however, he was insulted, and with scant ceremony sent home to Malangé. This occurred in 1848. The Government then sent a stronger force under the command of Major Salis, who blockaded Ndalla-Kissua, and sent the chief as a prisoner to Malangé. The residents in the Feira then entreated Salis to visit Bumba with a like punishment, and he complied with their wishes. Bumba, making his escape in good time, found refuge in Tongo-land. He was dethroned, and Kalunga-Kakistango was set up to reign in his stead. A peace of two years' duration ensued, after which the king, escorted by the Director of Feira and other white men, led an expedition to seek out Bumba and put him to death. Bumba's partisans, however, massacred the whole of this party, and Bumba himself returning to his native country, resumed its sovereignty. The whites were now seized with a panic, and fled to Malangé, whence a small army was despatched against Bumba, who, on its approach, fled to the Kuango, and for a time entirely disappeared. The Portuguese then

raised Kambollo la N'gongo to the throne. He died soon after, and was succeeded by Kameija, who also died after a very brief reign. Bumba then suddenly reappeared, and having apologised for his wrong-doing in the Feira matter, was again recognised as the sovereign. He now reigned, to the satisfaction both of his subjects and of the Portuguese, till the year 1861, when a deadly quarrel broke out between two chiefs in N'Donje about the succession to the throne, a quarrel in which both Bumba and the Portuguese took part. During the war a great chief of the family of Kalunga was captured by the Portuguese and beheaded. This set the whole country in a blaze of insurrection. The whites fled; the Bangala burst into the factory, plundered and destroyed it, and ruthlessly murdered every white man who fell into their hands. The Government then sent Major Casal with 150 men against the Bangala. They fled at his approach, and were pursued into the Kuango region. The Major, who with only a part of his force led the pursuit in person, was taken by surprise while encamped on the Savanna, and he and all his men were slain. The hands and scalp of the unfortunate Major were delivered to Bumba. The victors then attacked the rest of the Portuguese, who, however, repulsed them, and regained the Feira. Here for three months they were beleaguered by the fierce Bangala, and reduced by famine to the last extremities. Major Serra, who was now in command, surrendered on terms, and was permitted to return to Malangé. This leniency was due to the great desire of the Bangala for a renewal of commercial intercourse with the Portuguese, who supplied them with their luxuries. The Government was displeased with the arrangement which had been made, and sent Lieut.-Colonel Borga and the mulatto Mendes against the Bangala, but both of these officers allowed themselves to be corrupted. The Bangala then assumed a singular attitude towards the white men, robbing them when they showed themselves within their borders, and guarding against any transit being made by them through their country. They nevertheless at the same time carried the products of the interior into the Portuguese territory, where they traded as they found opportunity. The Portuguese traders on their side had a single eye to gain, and so met them with the utmost friendliness.

The succession to the throne is restricted now, as formerly, to the descendants of the three men, Kulanjingo, N'gongo, and Kalunga. When a vacancy occurs, a new sovereign is elected by four powerful chiefs, who have themselves no pretensions to the throne. These chiefs give the consecration to the elected king, and, amid other mysterious solemnities, administer to him a poisoned draught, which operates very slowly. They do this because the number of the members of the families which have the right of succession to the throne is great, and many of them eagerly wait for the time when it shall be their turn to wield the sceptre. A king seldom, therefore, reigns for more than three years. Bumba, knowing this, prudently declined the honour of consecration. After his death, his two sons disputed with each other for the succession. Both of these are now ruling in the country, but the feud between them still lasts.

The Ancient Inhabitants of the Canary Islands.—Mr. Harris Stone, M.A., contributed an interesting paper on this subject to the Anthropological Section of the British Association meeting in Bath. He stated that the name *Guanche*, though generally used for the old inhabitants of all the seven islands of the Canary group, should properly be only applied to the ancient inhabitants of Tenerife. The ancient inhabitants of these islands were ignorant of the use of metals, and up to 1402, when the conquest first began, had to all practical intents remained apart from the civilisation of that day. They were a branch

of the great Berber race, and probably also a tribe of that white dolicho-cephalic race of cromlech builders which at a very early period swept through Europe. Their connection with the ancient Egyptians was noticeable in many traits and customs. The ornamentations in caves and on pottery which the author had come across in his travels in each island of the archipelago were Egyptian in character. The method of embalming the dead, particularly the practice of removing the entrails by a slit made with the *tabona*, and the wrappings of the corpse, was very similar to that employed by the lower class of Egyptian embalmers. Though the ancient inhabitants of the islands had so much in common, there were so many specific differences in their languages, manners, and customs, that the conclusion was almost forced upon the investigator that they must originally have been peopled by more than one tribe of the same race. Mr. Stone had examined a large number of skulls in collections in the islands, and found them very European in contour and general appearance. In a large proportion of those in the collections in the islands he had noticed a peculiar indentation in the frontal bone, usually the left, and to his surprise found that of the twenty-six skulls at the Royal College of Surgeons, no less than fifteen possessed this mark, and of these ten on the left frontal bone. The ancient inhabitants are now quite extinct as a separate race, but Mr. Stone in his travels had noticed several traits, manners, and customs of the present inhabitants which were clearly in his opinion derived from the old race. The food *gofio*, and its method of making and eating; the number of cave-dwellings and villages; the still prevalent inter-insular jealousy; the size and great physique of the men of the Purpurariæ; the confiding, generous, hospitable character of the Conejeros; the use of the vaulting pole; the general absence of bigotry and religious intolerance; the preference to this day of the Gomeros to carry baggage on the head; the abomination of butchers; the torchlight fishing; the method of laying-out the dead; the wit of the Palmeros; the cleverness with which buildings are constructed with stones without mortar; the honesty of the Canarios; the unusual beauty of the peasant women, were points alluded to by the author in illustration of his assertion. The position of women was considered at some length, Mr. Stone bringing forward many facts to show that they held a far higher position in the social scale than was usual among ancient nations.

In the discussion that followed the reading of Mr. Stone's paper, Canon Tristram stated that the designs from caves in the islands were identical with those on Kabyle pottery in his possession. The traditions are evidently *pre*-Christian. The modern race are evidently substantially the same as the ancient, a *Kabyle* (blue eyes and reddish hair)—no trace of Egyptian or Negro blood—old customs handed down, *e.g.*, the mode of laying out the dead is similar to the arrangement of the limbs in the mummies found in Kabylia, show that the race is the same.

A skull being exhibited with the indentation on the frontal bone, several Members who examined it agreed that the indentation was due to a wound or blow received during life.

AUSTRALASIA.

New Guinea.—Mr. J. P. Thomson, our Hon. Corresponding Member at Brisbane, writes to us, under date 19th July, as follows:—Latest news from New Guinea, per Government schooner *Hygeia*, which has returned to Cooktown after a month's cruise in the Louisiade Archipelago and the eastern shores of the British Protectorate, states that the natives, who are at present peaceably disposed towards foreigners, have been satisfactorily performing work for the white traders at various places. Among the natives themselves, however, peace appeared to

have given place to open hostilities, as a head-hunting party had massacred six of the native inhabitants of Biowa, and carried off three children. The kidnapped children were, however, with some difficulty recovered from Broken Island, and returned by a friendly native interpreter, who had at one time been employed at Queensland, and, as a punishment on the aggressors, some canoes and native dwellings belonging to the tribe, at a village used as a base of operations, were destroyed by direction of the Special Commissioner. It has been ascertained that last year sixteen heads were surreptitiously taken in the islands of Joannet and Piron. This barbarous and infamous custom of head-hunting prevails to a great extent amongst the natives inhabiting the islands adjacent to the south-eastern portion of New Guinea, who make use of the heads as an article of commerce in trading with the islands of Woodlark and St. Aignau. Valuable information has, however, been obtained with regard to these island natives, and much light has been thrown on this barbarous custom by the Deputy Commissioner, Mr. A. Musgrave, junior, during the cruise of the *Hygeia*. It is considered that the punishment so promptly meted out to the offenders will have a salutary effect in checking the infamous custom of head-hunting. On the north coast of Juanita Island, the prospecting party, who were exploring for gold and tin, have shifted their position to examine new country. Copra (the dried kernel of the coco-nut) trading is carried on briskly at several native villages in Lille and Goodenough Bays. Bêche-de-mer is being collected at other places, and gum on the islands of Joannet and Sudest. The plentiful supply of these articles of commerce, and others of equal value, combined with the activity of local trade, and the known natural and artificial capabilities of the soil, have induced Mr. Musgrave, after careful consideration, based upon his three years' experience in the Protectorate, to entertain sanguine views of the future prosperity of the British Territory in New Guinea. Mr. Musgrave says that unless steps be taken to arrest the progress of the country, its development must continue progressive. In support of his views, he says the natural resources of British New Guinea are more than twenty times that of Jamaica, which has an annual exchange of trade equal to £3,000,000 sterling. Two centres of a growing trade are Granville and Samarai, both of which are convenient to Cooktown. He also refers to the Queensland Annual Statistical Register to show that appreciable contributions to the trade of Cooktown and Thursday Island have, in the last ten years, been made from British New Guinea. The natives, he says, are willing to work for the whites, and the climate is as good as that of Jamaica, where Europeans have, for several generations, lived in comfort. England and Australia, seem not as yet to have realised the valuable territorial possession gained by the addition of south-eastern New Guinea to the Empire.

The latest German New Guinea news states that Messrs. Herring, Langemark, and Schmele, while on an overland journey from Matupi to inspect the country, were surprised by natives armed with Snider rifles and spears. Herring was shot through the arm, and a bullet lodged in his back. On arrival at Finchhaven the bullet was extracted, and the patient is now progressing favourably. The other two members of the party, who were also wounded, have quite recovered.

In New Ireland even greater mishaps than the one narrated appear to have befallen German New Guinea colonists. The natives killed one white man and one native belonging to an exploring party under "Graphite"; Count Pfeill and Mr. Rocholl were deserted by their whole staff, which comprised thirty carriers with provisions and instruments; they had to subsist wholly on copra for some

considerable time until rescued by a missionary from York Island. No trace of the deserters was found.

POLYNESIA.

Cook Islands.—The newspaper press in September announced that several islands of the above group in the Pacific have been, or are about to be, placed under British protection. They were first discovered by Captain Cook, and received his name for their designation. A correspondent of the *Times* (3d October) thus describes the islands:—There are only about nine or ten islands in the whole group, with a population probably not exceeding 8000. Many of the natives go over to Tahiti as labourers, returning with considerable savings and improved habits. Rarotonga, the largest island in the group, is one of the most beautiful islands in the Pacific. The island itself is of volcanic origin, a mass of mountains rising to a height of about 3000 feet. It is about 30 miles in circumference, and surrounded by a coral reef. The reef has a few openings which afford harbours for small vessels, without shelter, although there are several good boat harbours. As a naval station, therefore, it cannot be held to be of any great value. The principal village, Avarua, is to the north, and vessels of 100 tons can enter its harbour and moor to the reef. Coffee, cotton, arrowroot, and coconut oil are the chief products, while pigs, turkeys, fowls, yams, sweet potatoes, and pine-apples are also produced. The people are not industrious, and the trade is of no great value. To the south-east of Rarotonga is Mangaia, about the same size, but not nearly so lofty. The population is also about the same, and, like that of Rarotonga, is Christian. The island is unprotected by a reef, and landing can be effected only in canoes. Atiu, the Wateeo of Cook, who describes at great length his friendly reception by the natives, lies to the north-east of Rarotonga, and is about 20 miles in circumference, with about 1000 inhabitants. The Hervey Islands proper lie to the north of Atiu, the largest being Artutaki, discovered by Captain Bligh in the *Bounty*, a few days before the mutiny. It is about 18 miles in circuit, extremely fertile, with a hill rising to 450 feet. Boats can enter the reef off the mission settlement on the north-west, but there is no anchorage. There is a population of about 1500. There are a few other reefs and islets belonging to the group, but, so far as has been ascertained, there is no anchorage for large vessels. A closer examination of the group may lead to the discovery of a harbour that might be of service in a future trade-route between the Panama Canal and our Australasian possessions. The islands are the centre of great English missionary enterprise; natives are trained there, and sent to all parts of the Pacific and New Guinea. Facilities for such enterprises are more likely to be obtained under English than under any other rule. No doubt, also, the oil and other industries for which the islands are adapted will be considerably developed.

ROUTES, RAILWAYS, CANALS, Etc.

Algerian Railways.—The line from Constantine to Biskra was opened for traffic on July 1st. The 238 kilomètres (148 m.) which separate the two towns may now be traversed in 10 hours. The railway will be prolonged later on to Tuggurt and Wargla.—*Le Mouvement Géographique*, Sept. 9th.

The Woermann Line.—The German West African Company has formed a scheme for establishing regular communication between Walfisch Bay and

Saint Paul de Loanda in connection with the steamers of the Woermann Line. The territories of the German Protectorate in south-western Africa would thereby be brought into direct intercourse with the Fatherland, and further, the Society would provide an important outlet for the products of the establishments it has founded in the meat trade.—*Le Mouvement Géographique*, 9th Sept.

The following have been gathered from the London *Chamber of Commerce Journal* for 6th August and 5th September :—

Projected New Lines.—The Government of Portugal have submitted to the Chambers a measure providing for the construction and working of a complementary network of railways to the north of the Mondego, for the purpose of connecting the most important localities of Traz os Montes, Douro, Minho, and Beira-Alta. This project, which will entail the construction of 619 kilomètres of line, is divided into four sections, which will be the objects of separate contracts : —(1) The line from Mirandela to Bragança, prolonging the line from Tez-Tua to Mirandela, length 74 kilomètres, estimated at 108,000 francs per kilomètre ; (2) line from Chaves to the Douro, following the valley of the Tamego (105 kilomètres) with a branch from Cavez [? Canavezes] to Braga (90 kilomètres), narrow gauge, estimated at 165,000 francs per kilomètre ; (3) line from Villa-Real to Vidago by Lamego, 193 kilomètres, narrow gauge, estimated at 115,000 francs per kilomètre ; (4) line connecting the railway from Biera-Alta to that of the Douro by Vizeu and San Pedro, 157 kilomètres, narrow gauge, estimated at 165,000 francs per kilomètre.

A Proposed Ship-Canal.—Preliminary observations and plans have been made for a ship-canal, which, if carried out, will cut Italy in two, and do away with the long voyage round Cape Leuca. Starting in the neighbourhood of Castro (?), on the Tyrrhenian Sea, the canal is projected to join with the Lakes of Bolsera and Trasimeno, and fall into the Adriatic Sea near to Fano. [Reliable particulars are wanting.]

Servia.—The Constantinople (Ottoman) *Journal de la Chambre de Commerce* states that the Servian Government have accorded to a German contractor, Herr Hardel, who formerly participated in the Strasburg railway project in Rumania, the preliminary concession for the construction of a railway between Gladovo and Nish, which will necessitate the construction of a bridge over the Danube between Gladovo and Turn-Severin. This line, in the opinion of the projectors, will turn a certain portion of Rumanian trade towards Servia.

Railway Extension in the Caucasus.—According to Odessa reports, the Russian Government have now definitely resolved upon connecting Sukhum-Kale, situated on the southern section of the Circassian coast, by rail with the Trans-Caucasian system at Poti. The distance between the two ports is 73 miles, and the proposed coastwise route by Nova Senaki presents no particular engineering difficulties. This railway will afford an outlet to another richly productive district of the Caucasus. The Russians have, of late, very much improved Sukhum-Kale. The place was formerly one of the worst hot-beds of malarious fever in the Caucasus, but it is now so far changed in this respect that a military sanatorium has been established there. With the construction of this railway, the Government will make another effort to colonise the coastlands with Russians. Hitherto these attempts have been followed with little success. Since 1864, the Government have induced no fewer than 450,000 Russian peasants to settle in various districts of the Caucasus, granting them free lands and other facilities, but of these assisted emigrants only a part have remained, and these are to be

found chiefly in the Kuban districts. The recent opening of the railway at Novorassisk [? Novorosiikoe] to be followed now by the Poti-Sukhum-Kale extension, affords an evidence that the Government have at last become alive to the great importance of thoroughly developing the various and abundant natural products of the Caucasus.

Canal Connection between the Obi and Yenesei.—According to St. Petersburg advices, the Russians are at present pushing forward with extreme activity the works by which water communication will be established between the two great Siberian rivers—Obi and Yenesei. It is thought that the canal will be open for general traffic within a year. There is no doubt that this communication will be of great importance to the southern Siberian regions, which are famous for their abundance of excellent corn.

Persia.—According to the *Commercielle Berichte*, a commencement has been made with laying down the rails for the railway from Teheran to Shah Abdul Azzim, only 6 kilomètres in length, which is to be opened in the autumn. But it is stated that another railway has been begun, which, although it is hardly talked about at Teheran, will be of great practical importance to Persia in the future. A very wealthy and influential Persian merchant has discovered a very good natural harbour at a distance of about 20 kilomètres from Mash-had-i-Sar, on the Caspian Sea. He bought the nearest village, Mahmudabad, and territory for a railway to extend for about 40 kilomètres to Amol, and the groundwork for this distance is said to be already completed. This railway is entirely in the Russian interest. It may be useful to mention that telegrams to Persia should be addressed "*viâ* Berlin per Indo" for prompter and safer despatch, as, if sent otherwise, they arrive often in a mutilated state, rendering them almost unintelligible, and they experience, besides, considerable delay.

MISCELLANEOUS.

The **Area** of the territory of the **British North Borneo Company** is 31,106 square miles, with a population of 150,000, being not quite 5 to the square mile.

A new Ordnance Survey Office has been established in Edinburgh, and has been placed under the charge of Major Thomson. After Lancashire and Yorkshire have been resurveyed, the **Scotland** sheets will undergo a thorough revision.

The *British North Borneo Herald* of August 1 publishes the text of the agreement between Her Majesty's Government and Rajah Brooke, creating **Sarawak** an independent protected State, and regulating the question of succession, relations with foreign States, and other internal administrative interests.

According to the *Deutsche Colonialzeitung*, there were, in the year 1887, 597 **Germans in China**, and 65 houses of business carried on by Germans. Germany, therefore, takes the second rank among foreign nations; and her position with regard to Great Britain is in the proportion of 1 to 4.—*Le Mouvement Géographique, Sept.* 9.

Mr. John W. Turner, in *Sheep and Wool*, estimates that the number of **Sheep in the United Kingdom**, inclusive of lambs, was, in 1887, 29,336,594; and in 1888, 28,883,010, showing a decrease of 453,584. The gross wool-clip for the present year he believes to amount to 167,969,861 lbs., fleeces weighing from 3½ lbs. up to 9½ lbs. each, the average for Scotland being 5 lbs. per fleece.

The latest accounts from Mr. Philip Sewell regarding his scientific expedition in **Siberia** are unfavourable. Much valuable time was lost through the wreck of the *Phœnix*, and, although another vessel was despatched without any unnecessary delay, the ice, which seems this year to have come further south than usual, and sooner than is generally the case, threatened to prevent an excursion into the Kara Sea. Regarding **Vardo**, from which Mr. Sewell writes, it is stated that the principal trade consists of traffic in whale and cod-liver oil, and dried cod-heads, the latter being used for manure. The shark fisheries are of some value, and engage a number of hands. The plants found in the district are similar to those of the northern mountains of Scotland. Lichens and some small, low-growing grasses are common. Trees, in the usual acceptation of the term, are unknown ; the mountain ash only reaches a height of twelve inches or so, except in gardens, where it sometimes reaches four feet. Willows grow in the same way. We hope that, on Mr. Sewell's return, he will communicate the results of his expedition for publication in the Magazine.

NEW BOOKS.

Eclectic Physical Geography. By Russell Hinman. Cincinnati and New York : Van Antwerp, Bragg, and Co.

Mr. Hinman's beautiful octavo volume of 382 pages is in several respects the best book on physical geography we have seen. It is arranged on a definite principle which is consistently carried out, the facts chosen to illustrate the general laws of Nature are handled skilfully, so as to instruct and not distract, and the details given are always of positive value. After a short introduction, which summarises the essential properties of matter and energy, the book is divided into six parts. The first treats of the earth as a planet, but does so rather more briefly and less clearly than could be wished. Part II. describes the phenomena of the atmosphere at length, and, notwithstanding an imperfect explanation of evaporation, with great distinctness, aided by the happy expedient of showing the isotherms and isobars on polar maps and the rainfall on an equal area projection. Part III. (the Sea) embodies the recent researches on the abysmal area and its deposits, and is illustrated by a very pretty but unacknowledged reduction of Mr. J. G. Bartholomew's bathy-orographical chart of the world published in last January's number of the *Scottish Geographical Magazine*. Reference is made, however, to Dr. Murray's paper on drainage areas in an earlier issue of the *Magazine*. Part IV. (the Land) deals in some detail with the origin of surface features and the relief of the continents ; the formation of mountains, glaciation, and the phenomena of earthquakes being peculiarly well treated. In this, as in Part V. (Climate and Weather), the illustrations and instances are mainly American, although the book is written throughout in a purely scientific and impartial spirit. Part VI. (Life) is, as is usually the case in sketches of physical geography, the least satisfactory. Too much is attempted in discussing morphology and classification, and the pictures of beasts and birds are positively disappointing, the amorphous ungainliness of the drawing contrasting painfully with the perfect printing of the wood-cuts.

Emphatically this is a book to improve the status of geography as a science, and as a science at once precise, reasonable, and popular ; the defects we have pointed out are insignificant compared with the excellencies of conception and execution which every page displays.

It is almost with a feeling of regret that one surveys the recent additions to geographical text-books beyond the Atlantic, where publishers seem to grudge neither pages nor pictures, and compares with them the one or two good and many bad, but all contracted and ill illustrated, productions which suffice the British public. In the present instance there is no such cause for regret; an edition of Mr. Hinman's volume for British readers being advertised for immediate publication by an Edinburgh firm. This edition, if, as seems probable, it is extended by the addition of instances from the geology and meteorology of the British Isles, and by giving more prominence to such classic theories as Darwin's on coral-reefs (to which Mr. Hinman makes no reference), will be a boon to the teachers of geography and their pupils.

Elementary Commercial Geography. A Sketch of the Commodities and the Countries of the World. By HUGH ROBERT MILL, D.Sc., F.R.S.E., F.R.S.G.S. London: C. J. Clay & Sons, 1888. Pp. 132. *Price* 1*s.*

This new Primer is admirable in every respect, and should be welcomed by those studying the subject as a branch of their education. Dr. Mill considers the question in three aspects: he describes the world and its contents as a workshop at rest, containing raw materials, machinery, and power; he discusses the rules to be observed by the workers to ensure the best results; and he pictures the actual present condition of the world-workshop with all the different departments of production, distribution, and consumption in full operation. The first few chapters are devoted to a review of the articles of commerce according to whether they belong to the animal, vegetable, or mineral kingdom, then the means of transport and the laws and usages of commerce and commercial nations are discussed, and the concluding portion embodies a very complete account of the different countries of the world looked at from a commercial point of view. Altogether, this little book contains a vast amount of correct, well-arranged, and interesting information, which will be of great use to those for whom it is specially intended. The statistics given are clear and simple, and the chapters are divided into short numbered paragraphs, each complete in itself.

A perusal furnishes the best argument for the necessity of the introduction of such a text-book into our system of education. The state of commerce described is that existing in 1888, and every page brings some proof of how constantly and irresistibly the course of trade alters. It is inevitable that most of the space should be allotted to the United Kingdom and its possessions as the leading commercial country at present, but several other nations are beginning to push us hard, and only by the thorough commercial training of our merchants and manufacturers can our position be kept. Dr. Mill makes his readers look upon the world as a storehouse for the benefit of all its inhabitants. Commodities exist in one continent which are wanted by people living in another, Europe needs articles produced by America, and *vice versa*. It is for the advantage of all that exchange should be made with the greatest freedom; barriers, whether natural or artificial, prevent the full enjoyment of the bounties of nature. The natural barriers have been gradually overcome, but many artificial restrictions still exist. Tariffs prevent free interchange, and war is the most deadly foe to commerce. One interesting instance is given of how war affects commerce even in time of peace: "The northern and southern states of the American Union had formerly different railway gauges, as a political precaution in case of war, that of the north being 4 feet $8\frac{1}{2}$ inches, and that of

the south being 5 feet; but on June 1st 1886, a change was made simultaneously on 13,000 miles of line, one rail being shifted 3½ inches to become uniform with the standard gauge of the north."

The author has been very successful in his effort to treat each country or colony from the standpoint of a native, and this cosmopolitan nature of the book does much to enhance its value.

The Economic Interpretation of History. By JAMES E. THOROLD ROGERS, London: T. Fisher Unwin, 1888. Pp. 524. Index. *Price* 16*s*.

Professor Rogers has collected a course of lectures he delivered (1887-88) to his students in Worcester College Hall, Oxford, which, published in book form, should be welcome to the public. Judged from the geographical standpoint, there are chapters of high value to the student of Commercial Geography. These deal, respectively, with the commercial aspects of international trade, imports and exports, the rise and development of trade between the East and West, and, incidentally, of geographical discovery, labour and its effects, taxation and the distribution of wealth, currencies, social phenomena, historical effects of high and low prices, domestic manufactures, the rise and progress of colonial trade, Protection and Free Trade, public debts, service and supply, etc. Illustrated by historical parallels, the inferences which the author draws are of course open to the objection of individual interpretation; and, in connection with this remark, it may be as well to express our opinion at once, that Professor Rogers does not show sufficient liberality of spirit in criticising the views held by his opponents: perhaps it is in consequence of the lectures having been prepared for his class, and not for the public, that they are somewhat pedagogic in spirit and slovenly in style. A judicious editor would have remedied these defects, but we see no signs of careful editing; the author's invectives against Mr. Howard Vincent, who has sought to revive the cry of Protection, are specially objectionable, although we do not in the least share the views of his victim.

It is more pleasing to refer to some of the more admirable and effective services which Professor Rogers, as an economist, renders to us as geographers. His system of seeking out historical parallels to substantiate his interpretation of the economic principles underlying the intercourse between nations is, we need scarcely remark, a sound method of investigation. His lectures are most instructive and valuable to the student of Industrial and Commercial Geography who seeks to inquire into the development of our colonies who have protective tariffs, and their relation to the mother country, or of foreign nations whose protective duties handicap British trade and commerce. "A protective tariff," he says, "is to all intents and purposes an act of war," and his advocacy of Free Trade is most conclusive. His strictures on the policy which has governed nations who have waged wars in order to secure "sole markets" are also most deserving of our attention. He says (p. 323):—

"The doctrine that the commercial prosperity of a country depends on the creation, maintenance, and extension of a sole market for its products and for its supplies, was prevalent from the discovery of the New World and the Cape Passage down to the war of American Independence. This was the principal object of Borgia's Bulls. This was the motive which led to the charters of the Russian Company, the Levant Company, the East India Company, the Turkey Company, the Hudson's Bay Company, in England. The theory was organised in the colonial system, which Adam Smith examined, attacked, and, as far as argument could go demolished in his great work. But the dream of a sole

market is still possessing the Germans and the French. The insane passion for this costly and ruinous monopoly has led to the raid on Tonquin, and the scandalous and unjustifiable attack on Madagascar by the latter, to the Protectorate of Zanzibar, the settlement of Angra Pequena, and the occupation of North New Guinea by the former. How long the experiment will be persisted in I cannot guess. Nations and governments are seldom willing to confess themselves to have been in the wrong, and, indeed, nations have little opportunity for giving effect to their regrets, as long as their rulers are impenitent, and do not personally suffer for their errors. But this I can predict with confidence. For every pound's worth which these peoples buy and sell in their conquests and occupations, they will have to pay another pound out of German and French taxes in order to maintain and secure the sole market, even if they get off as cheaply as that. I know pretty well what our colonies of conquest have cost us, and still cost us. These colonies of conquest were all made with the object of a sole market, and we have in return from the people whom we have created, protected, and maintained at an enormous cost, the grateful acknowledgment of hostile tariffs."

And again (p. 324) :—"The most important sole market which Great Britain had acquired by her wars was the seaboard of North America. To support the finances of the chartered company, the British Parliament determined on taxing the inhabitants of her sole market, and the result, as you know, was the war of American Independence, and with it the explosion of the theory which I am about to describe."

In view of the hesitating dependence of Canada, not to mention other British possessions, these remarks of Professor Rogers should be taken to heart by our legislators.

We are willing to award the most hearty welcome to the important contribution to economical science which Professor Rogers has made in this new volume.

Tenerife and its Six Satellites : or, the Canary Islands Past and Present. By Olivia M. Stone. London : Marcus Ward and Co. 2 vols. ; pp. 477, 459. Index, Appendices, Maps, Illustrations. *Price* 42*s*.

Had Mrs. Stone been content to have issued her two portly volumes as the diary of a lady's travels in the Canary Islands, we should have been disposed to extend to her "work" almost unqualified praise. But she claims for it an importance it in no wise possesses. Although she appears to have, as she says in her Preface, "consulted all the works treating, however remotely, on the subject which have appeared (*sic*), whether in English, Spanish, French, or German," she evinces no honest appreciation of any but her own efforts. This self-sufficiency on her part, which pervades all her descriptions, is the more surprising because she has so largely availed herself of the work of previous travellers and writers in the same field. Her preface prepares one for a carefully arranged and original discussion of her subject, and raises the hope that her volumes may be received as *the* standard work. But the reader cannot fail to be disappointed. Both volumes abound in the trivialities of her personal experiences, such as : "*September* 17*th*, *Monday*.—John had toothache last night, and feared he could not sleep without some chlorodyne" (page 159, vol. i.). In several places her scientific spirit inspires her to mention the precise number of human parasites caught in the night season.

She thinks nothing of sandwiching a grave historical retrospect between a

morning stroll and an afternoon call. In fact, there is no appearance of arrangement or collation : the volumes are apparently a mere transcript from the author's diary, and the reader who seeks information must wade through pages of trivialities to pick out the scattered crumbs of knowledge. Mrs. Stone's affectation of scientific precision is amusingly illustrated by her gravely recording, on nearly every possible occasion, the exact moment of arrival and departure (which, of course, in the case of journeys alone, would be right enough), the temperature of her sleeping apartments, and their respective heights above sea-level, etc. Of botany, however, she has considerable knowledge, which greatly enhances the value of her descriptions.

That these volumes contain a vast amount of material for study cannot be denied ; they simply bristle with facts. But they require careful editing to make them of any real service to the busy student, who (unless he is a near relation of the author) cannot be expected to take a lively interest in her diet or the incidental trifles of her journeys. Those who have the time and courage to wade through them will doubtless be rewarded in one way or another ; though we cannot help feeling that Mrs. Stone, by the exercise of a little more modesty, by ruthless pruning, and careful editing, would have done more credit to herself and rendered a greater service to the public had she entirely rewritten from her notes the information she was able to collect, and compressed it into a single volume. We regret to add that her style of writing is neither fascinating nor correct, and grammatical errors, which surely might have been corrected in proof, abound on every page.

The publishers deserve credit for their share of the work. The volumes are handsomely "got up," and the illustrations are many and excellent ; only the maps are badly reproduced. The appendices are useful.

Holland. By James E. Thorold Rogers. Pp. 380. Index.
Turkey. By Stanley Lane-Poole, assisted by E. J. W. Gibb and Arthur Gilman. Pp. 365. Index. London : T. Fisher Unwin, 1888. *Price* 5*s.* each.

These two volumes form part of the excellent series of the *Story of the Nations* now being issued by Mr. Fisher Unwin. The arrangement and treatment of both are excellent. Mr. Thorold Rogers, Professor of Political Economy and Economic Science, shows in *Holland* a thorough grasp of his subject. To us, as geographers, the accounts of Holland's colonising activities are specially interesting. Mr. Stanley Lane-Poole, the well-known Orientalist, and his assistants, have given us an eminently readable, account of Turkish history, although the more recent events leading to the dismemberment of the Ottoman Empire in Europe are only perfunctorily treated. The stirring and varied history of Turkey is, of course, in a book of this size, only sketched in broad outlines, but to the general reader it will supply sufficient detail. There are evident signs of haste in the compilation of *Turkey ;* the most reliable statistics, if we may judge from a reference to those of the Balkan States, do not appear to have been consulted. As an example of carelessness, we may quote (on p. 364) the substitution of "Servia" for Herzgovina which, with Bosnia, are stated by the author to be administered by Austria. We are not aware of this political change having as yet taken place. A special feature in the text calling for commendation is the spelling of place-names, which is based on the modern phonetic system. The type maps in both volumes are wretched and next to useless, but some of the other illustrations are interesting and well executed.

Voyage à Merv: Les Russes dans l'Asie Centrale et le chemin de fer transcaspian. Par EDGAR BOULANGIER, Paris: Librairie, Hachette et Cie, 1888. Pp. 447.

The author's route from Paris was by the Trans-Caspian Railway to Merv. He describes the incidents of his journey in a pleasing style, but the book, which is largely made up of extracts (excellent enough in themselves), can claim to possess no original importance. As an engineer, he, however, gives us some useful technical information regarding the construction of railways in Asiatic Russia; and he has an intelligent grasp of the economical and political importance of the new Russian enterprises. Had he continued his journey further east, to Samarkand, he might have had more opportunities of original observation. From Samarkand, the Trans-Caspian Railway is to be continued to Tashkend, where it will unite with the direct line to Petersburg *viâ* Orenburg. The eighty-four illustrations and fourteen sketch-maps are the chief attractions to M. Boulangier's book; they are admirably executed.

The Land of the Vikings: a Popular Guide to Norway. By C. JURGENSON. Illustrated. London: Walter Scott, 1888. *Price* 3*s.* 6*d.*

This is an improved edition of a work published in 1884. Its style and arrangement are of a very serviceable and popular kind. Such useful information as is contained in the Tables of Towns, Currency, Exchange, etc., adds to the value of the work, which is completed by a copious Index.

NEW MAPS.

AFRICA.

BASUTO-LAND, constructed from the latest map compiled at the Intelligence Division, War Office, and from information supplied by the Department. Scale, 1:550,000. *Proceedings of the Royal Geographical Society, August* 1888.

KAMERUN, Karte des Deutschen Schutzgebietes von ——. Nach dem jetzigen Stande der Kenntniss, entworfen und geziechnet von L. von der Vecht. Massstab, 1: 770,000. *Berlin: Mitt. von Forschungsreisenden u. Gelehrten aus den Deutschen Schutzgebieten, II. Heft.* 1888.

LE KASSAI et la Louloua de Kwamouth à Louebo, levés à bord du steamer "Stanley," par le capitaine Thys, officier d'ordonnance de S. M. le Roi des Belges. Scale, 1: 200,000. *Bruxelles: Institut National de Géographie*, 1888.

This is the first practical chart of the Kassai, a river which will no doubt soon become a most important highway into Central Africa. Soundings are only given where the depth is less than 10 feet, and as we find none from Kwamouth to the junction with the Lulua, a distance of about 80 miles, we may infer that all this part at least is open for steamer navigation.

SANKURU-STROMES, Original-karte des ——. Nach den Anfnahmen von Dr. Ludwig Wolf, 1886, konstruiert, und mit den Aufnahmen der Wissmannschen Expeditionen von 1884-85. Massstab, 1: 600,000.
Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 12. *Gotha: Justus Perthes.*

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Proceedings of the Royal Geographical Society, October 1888.

WITWATERSRAND GOLDFELDER. Reduziert von Troye's Karte von F. Jeppe. Pretoria, Süd-Afrik. Rep. 1888. Massstab, 1:1,500,000.
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ASIA.

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Proceedings of the Royal Geographical Society, September 1888.

ARABISCHEN MEERBUSENS (Roten Meeres)—Tiefen-karte des ——. Entworfen und gezeichnet von W. Weber. Massstab, 1 : 4,000,000.
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CENTRAL ASIA from Pekin to Yarkand, and Kashmir *viâ* the Mustagh Pass, illustrating the Journeys of Lieut. Younghusband. Scale, 1: 5,500,000.
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NEW ATLASES.

ATLAS UNIVERSEL de Géographie Moderne, ancienne et du moyen âge, construit d'après les sources originales et les documents les plus récents. Avec un Texte analytique, par M. Vivien de Saint-Martin. 8e Livraison, contenant : *France* en 6 feuilles au 1,000,000e. *Feuille I. et II. Antilles.*
Paris : Librairie, Hachette et Cie. 5 *fr.*

Although the progress of this elaborate atlas is still extremely slow, the high standard of cartography which is attained in it almost reconciles one to the delay.

BERGHAUS' PHYSIKALISCHER ATLAS. Sechzehnte Lieferung. Inhalt : Nr. 6, Gletscherkarte (Dr. H. BERGHAUS) ; Nr. 66, Völkersitze um 1500 und 1800 (Dr. G. GERLAND); Nr. 69, Südost-Asien, Uebersicht der sesshaften Bevölkerungen um 1800 (Dr. G. GERLAND). *Gotha : Justus Perthes. Price* 3 *M.*

PHILIPS' Handy-Volume Atlas of British America. With Statistical Notes and an Index by J. FRANCON WILLIAMS, F.R.G.S.

PHILIPS' Handy-Volume Atlas of Australasia. With Statistical Notes and an Index by J. FRANCON WILLIAMS, F.R.G.S.
London and Liverpool : George Philip and Son. Cloth, 1*s.* 6*d.*

These little atlases, which are neatly got up, are separately published sections of "Philips' Handy-Volume Atlas of the British Empire," already noticed.

THE CHARTERHOUSE Oxford and Cambridge School Atlas, consisting of twenty-one maps, arranged to show all the principal towns, rivers, mountains, and places mentioned in the Oxford and Cambridge Geography.
London : Relfe Brothers. Limp cloth, 1*s.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ANNIVERSARY ADDRESS: THE HISTORICAL ASPECTS OF INDIAN GEOGRAPHY.

By Sir William Wilson Hunter, K.C.S.I., C.I.E., LL.D., Etc.

(*At a Meeting of the Society, Edinburgh, November* 6, 1888.)

My Lords, Ladies, and Gentlemen,—

I thank you for your kind welcome, and it is with a very sincere pleasure that I appear before you this evening, in response to the invitation of the Royal Scottish Geographical Society. For the Council of this Society, in selecting India as the subject of its Anniversary Address, has chosen a field of geographical research rich in results to science, and of vital importance to our nation. It will be my duty to rapidly unroll before you the long series of labours by which that far-off land of prodigy and fable has been brought within the realm of verified knowledge. But the record is not merely a panorama of scientific achievement; it is a picture-writing from the remote ages of the great struggle between man and nature which forms the permanent discipline of our race.

Many influences have of late combined to bring India closer to us. The Jubilee procession of last year, when our beloved Queen went to offer thanks to the Almighty for His goodness to herself and her people during her long and glorious reign, attended by her splendid escort of European and Indian princes, made the nation realise, as it had never realised before, that Her Majesty is not only the august sovereign of Britain, but also a great Asiatic Empress. That procession, unique in the world's history, and magnificent beyond the most gorgeous triumph of imperial Rome, awakened a nobler and a broader sense of nationality in three hundred millions of subjects, from the hearths of our Scottish Highlands to the homesteads of Hindustan. Conspicuous above all, and cheered loudly beyond the rest, rode a commanding presence in white

uniform, that spotless royal knight in spotless raiment, whom on earth we shall never see again. And I think that we Scotsmen, to whom our Sovereign Lady has so especially endeared herself by her Scottish home life, may be permitted in a special manner to participate in her great home sorrow. I feel at any rate that this Society, which gratefully remembers the distinction accorded to it by Her Majesty in commemoration of her jubilee, would not desire its anniversary to pass without expressing its deep and loyal sympathy. For it is not alone the beloved husband of our Queen's beloved daughter, and the most powerful Emperor of Europe, the illustrious head of an honoured and a kindred nation, whose loss we deplore. It is also the enlightened patron of science, the munificent yet delicate helper of men of learning, the friend of all faithful and honest workers throughout the world. We bow our heads in the presence of this great international calamity. But God in His own time makes clear His own design. And then it will be found that Germany and Britain have a new and dearer bond in their common reverence for that noble pattern of Christian fortitude and manly endurance, and in their mutual memories of the knightly and imperial and most loving soul that has passed away.

In India the earth and skies are more terrible things than we feel them to be in the temperate zone. Mountains, rivers, deserts, wind, rain, and dew, there control with an irresistible compulsion the destinies of man. The configuration of the mighty triangle, nearly equal to all Continental Europe, less Russia, which juts southward from mid-Asia into the tropical sea, marks it out as a vast isolated field on which the agencies of earth, air, and ocean might wage their warfare on a Titanic scale. It is as if the Almighty had set apart a region of this planet in which the forces of nature might run to and fro undisturbed and do His bidding. We still behold the rivers rending the rocks, carrying down thousands of millions of tons every year from the distant mountains, and causing the dry earth to rise out of the waters. The ancient secrets of land-making are laid bare; the drama of Genesis is acted before our eyes; and we may stand by and witness, as in a stupendous miracle-play, the third morning of the Mosaic creation.

The vastness and the isolation of India, walled out by the Himalayas from the rest of the world, and projected nearly two thousand miles into the ocean, enable the elemental forces to carry on their work with but slight interruptions from local and variable causes. A majestic order is there revealed in all things. Earth and ocean act and react on each other with a regularity of meteorological results here unknown. The solar heat, and the evaporation of the surrounding tropical expanse of water, produce an almost unvarying procession of phenomena each year. Nor is this imposing uniformity confined to the annual revolutions of heat, wind, and rain. It seems also to disclose itself in more recondite cycles spread over longer periods, which are only now coming within the range of continuous research.

The overwhelming forces of nature have in India at all times pressed heavily on the imagination and the lot of man. They profoundly influenced

his ideas about God. They gave form to his mythology. They shaped his history. They regulate with a minute and imperious discipline his social institutions and his daily life. It will presently be my duty to point out the reservations under which such inferences with regard to the influence of nature upon man must be received. The danger of confounding coincidence with causation can scarcely be eliminated from them. But subject to this caveat, it may be safely said that as the stupendous scale of nature in India and its uncontrollable forces seem to have modified religious conceptions, so also they appear to have powerfully reacted on the social and industrial economy. Man in India found himself too weak to stand alone against nature. The chances against the individual are heavy, and at the same time the general conditions are highly favourable to the increase of the race. Isolation has always there been felt to involve serious risks. The gregarious instinct in man accordingly received a very full development in India, and it still exhibits a remarkable vitality. The ancient human groups have there offered a firm resistance to the centrifugal and isolating tendencies. The undivided family maintains much of its old coherence in the midst of a complex system of individual rights. The caste binds together the family groups, and the separate trades or handicrafts into strongly organised guilds (or semi-religious, semi-industrial corporations) of remote ethnical origin, but with a very practical modern basis of reciprocal obligation, reciprocal supervision, and reciprocal help. The social institutions of India which disclose the most characteristic vitality, are those which most effectively discharge the functions of mutual assurance societies. Taken as a whole, they do the work of a poor-law for a dense population, subject to all the calamities of the tropics.

This appears clearly among the agricultural masses, who are most obviously at the mercy of nature. Until our own time, the village commune was the one stable unit of rural organisation in India which raised its head above every succeeding inundation of conquest. And the village commune involved many sorts and degrees of mutual insurance, from a joint responsibility for keeping up the continuous embankments against the river, or for maintaining the common reservoir or irrigation-lake, to a joint liability for the revenue or even a joint distribution of the crops. As the cultivator finds himself better secured against the vicissitudes of the seasons by the scientific appliances of British rule, he grows more self-reliant. When he knows that he can protect his own fields by Government irrigation, or supplement a local failure of crops by grain bought at cheap rates by State railways from other provinces, he insensibly becomes less anxious about his individual risks. It is no longer so necessary for him to spread those risks over a joint village group. One of the strongest solvents of corporate village rights in India has been found to be canal water. But the most characteristic of the rural institutions of India are still those which act as a mutual assurance against the calamities of nature and the mischances of life.

Not less masterful has been the influence of the Physical Geography of India upon its political history. The configuration of the country

gave a uniform direction during ages to the invasions of India, and set precise limits to each successive empire. The dynastic problem in India for hundreds of years preceding our rule was how to weld together the north and the south, in spite of the geographical obstacles. The Mughal sovereigns staked their empire upon the solution of this problem. They staked, and they lost. The fate of previous dynasties had shown that Northern India alone could not permanently withstand the influx of fresh invading races from the hardy breeding-grounds of Central Asia. A consolidated India under a vigorous rule might be able to do so. This was the dream of the Mughal dynasty. The last of its great emperors wrecked his armies and his revenues in a fifty years' struggle against the barriers which nature had set up between the north and the south. Out of the magnificent fragments of his empire, the British nation has built up a united India. But it is only in these last days that modern man, with the aid of the railway, the steamship, and the telegraph, is in India emerging victorious from the long struggle with nature. The dream of the Mughal emperors has become the reality of British rule.

In starting at the outset with a summary of the human aspects of Indian Geography, I have not thought it needful to vindicate before your learned Society this method of treatment. For one of the irresistible conclusions of recent research is that if geography is to keep its place as a progressive science, it must deal not alone with the physical configuration of the earth, but also with the relations of physical configuration to the phenomena of life. This view, after being carefully worked out in Germany, has now been accepted in Britain. The successful labours of the Royal Scottish Geographical Society in this direction, its public lectures, its exhibition of geographical appliances, its examinations and prizes, form parts of a well-organised scheme for encouraging the study of scientific geography in Scottish schools. The University Extension Scheme has recently included a course in Physiography by Dr. Mill, and the Heriot-Watt College in Edinburgh has instituted a class for Commercial Geography. How very practical and, at the same time, how strictly scientific the study of the new geography may be rendered in capable hands may be judged from the admirable work by a distinguished member of the Council of this Society, Dr. George Smith. Dr. Smith's volume is the first systematic geography of British India, a model of careful research and of able exposition, which has done more than any other book to render the physical facts of our great Eastern dependency intelligible to the British nation. A more general statement of the aims and methods of the new science of geography is given in the brilliant yet deeply philosophical article recently written by Mr. Scott Keltie. The learned dissertation of Sir George Birdwood on "The Maratha Plough" shows what can be done by the application of scientific geography to local history in India.

During the past year, also, the study has been recognised for the first time by the two great English Universities; and the President of the Royal Geographical Society, in his inaugural course of lectures at Cambridge, clearly explained the character of the teaching which that

Society has aided with its funds to establish. The new teaching does not exclude our former conceptions of geographical research. Scientific geography must still, and at all times, be built upon the sound basis of geodetic and topographical work. But it is not the old geography of our school days—the dry bones of terrestrial mensuration and the nomenclature of the earth's surface—that the English Universities have now undertaken to teach. It is, to use the name given to it by General Strachey, Applied Geography, or broadly speaking, the relations of terrestrial configuration to terrestrial life. On this wide subject, Mr. Mackinder, the newly-appointed Reader in Geography at Oxford, delivered forty-three lectures during the past year. He has successfully claimed a recognition for the study alike in the School of Natural Science and in the School of Modern History. In one course of lectures he treats of geography from its scientific aspects; in another concurrent course he deals with it in its relations to history. During last term he delivered a series of most valuable lectures on "The Influence of Physical Features on Man's Movements and Settlements" to audiences such as seldom come together in Oxford professorial halls. The heads of the historical school at Oxford have actively entered the field. Professor Freeman announces a course of lectures on "The Historical Geography of Europe"; and Mr. Sidney Owen, the learned historian, to whom India already owes so much, continues to treat Indian history on the basis of Indian geography.

The doctrine of the dependence of life on geographical conditions has been systematically elaborated in connection with plants and the lower animals. But the supreme problem of the action of geographical environment on man is beset with greater difficulties. For while plants and the lower animals can do little to modify their physical surroundings, man can do much. He gradually advances from an animal-like dependence upon his environment into a long struggle with nature—a struggle in which millions of his species are destroyed, but from which the most effective races derive an invaluable training and stores of accumulated knowledge. In the final stage it is difficult to pronounce as to whether man, with the aid of science, more profoundly modifies his environment or is more controlled by it. The problem is no longer one of the direct action of geographical conditions upon life, but of the complex interaction between man and his physical surroundings. When the problem is carried still further, from man as a biological structure to man as a historical development, new sources of error arise. At each extension of the doctrine of the dependence of life on external conditions into the domain of civilised humanity, it becomes less susceptible of verification. The chain of sequence weakens as it lengthens out, until it may in rash hands degenerate into a mere *post hoc ergo propter hoc.*

In speculations such as we are now entering on — speculations which cannot be brought to the touchstone of direct experiment—a wise diffidence should govern our speech and control our conclusions. We can see that in India the majestic scale of nature and the overwhelming energy of its forces have gradually influenced man's conceptions about God. We can see that geographical and climatic conditions have

tended to a full development of social and rural institutions of a certain type, and have given to that type a marked degree of vitality. But we cannot yet say, and we shall probably never be able to state, in what precise degree the physical conditions have contributed to the historical result. The great equation of the interaction between man and nature cannot be determined by any formula of algebra. The finest instruments available for the research still leave its process one of qualitative and not of quantitative analysis. Especially is this the case in regard to the political aspects of Indian geography. We can see that certain river valleys have in the long-run determined the line of march of Indian mankind; that certain chains of mountains have in the long-run set limits to successive Indian empires. But on scrutinising the individual episodes of Indian history, we find that in every case purely human and even personal influences have intervened to determine the result. The march of the races has been deflected from the natural route, and turned to the right hand or to the left by causes quite independent of the geographical conditions. Armies have halted and the tide of empire has been turned back, not because a river or a mountain range could not be crossed, but because, as it seemed, at the very moment when the natural obstacle would be overcome, an emperor dreamed a dream, or a rebellious son broke out into revolt in a distant province. All that we can establish is that the constant factor of geographical configuration has, in certain definite directions, slowly, steadily, and powerfully controlled the course of Indian history.

The first essential for the study of the historical movements of mankind in India is, therefore, a knowledge, at once comprehensive and exact, of Indian geography. That knowledge has, during the past eighty-eight years, been supplied by a series of operations conducted by the Government, with a magnitude of resource and with a continuity of effort which have no parallel in the annals of research. The trigonometrical mensuration of the Indian continent as a whole, its topographical delineation province by province, a geological survey of its land structure, a marine survey of its coasts and ocean approaches, astronomical observations, and a strongly organised meteorological department have accumulated invaluable materials for the scientific geographer. Nor have the investigations stopped short at the phenomena of inert matter. The plant-life of India, and certain divisions of its animal-life, have been comprehensively studied; the archæological survey has revealed the progress of man in the past: the statistical survey exhibits the population district by district, and systematically records the conditions, physical, moral, and economical, of human life in the present. While Germany has been elaborating with admirable industry the principles of Applied Geography, England may claim to have stored up in India materials on an unrivalled scale for the practical structure of the science, from the initial stage of geodetic mensuration to the final problem of the influence of terrestrial environment upon man.

I propose, before indicating some of the main results from this vast totality of effort, to explain the principal classes of the materials now available for the historical geography of India. The first class is derived

from philological research. That research divides itself into two branches in India: the study of Indo-Aryan languages, for which we are largely, although—thanks to Bengal civilians—not altogether indebted to German scholars; and the study of the non-Aryan Indian dialects, of which Bishop Caldwell's Dravidian Grammar forms the monumental work. The early literature of India comes next, particularly the Veda and the Epic Poems. These are now for the most part available to the student in English renderings, many of which we owe to native Indian translators. From the fifth century B.C., to about 200 A.D., we have the notices of India by the Greek travellers and geographers, including the surviving abridgment of Ktesias, the fragments of the ambassador Megasthenes, the Indika and Anabasis of Arrian, the geography of India as given by Strabo and Ptolemy, and the Periplus of the Erythræan Sea. Herodotus knew nothing of India beyond the Indus. An excellent collection of these Greek notices of India has been edited in English by a member of the Council of this Society, Mr. J. W. M'Crindle. Coins and inscriptions supplement them, and bring down the materials, with an interval of obscurity, to the fourth century A.D. The Chinese pilgrims to the Buddhist holy places in India, take up the thread of the story in 399 A.D., and supply valuable, although intermittent data, down to the year 645. The itineraries of these venerable travellers, after careful study by French and German scholars, have been systematised by General Cunningham in his Geography of Ancient India, and re-examined, with the aid of the latest lights, by the Rev. Samuel Beal. The mediæval writings of Hinduism, the Puranas, and Acta Sanctorum of the great Hindu sects, continue the chain of evidence onwards from the eighth century A.D., until the uprising of the modern vernacular literature of India.

Meanwhile the Muhammadan geographers and historians have come upon the scene. Their almost continuous flow of narrative from the ninth century to the nineteenth, has been rendered available to the English student by Sir Henry Elliot's eight volumes, and in many isolated translations and monographs. From the thirteenth century onwards, European voyagers also make their appearance in India; from the Venetian noble and the Catholic friar to the Portuguese and Dutch admirals, and the captains of British East Indiamen. This period of early European discovery finds perhaps its three most characteristic expressions in Marco Polo, the *Lusiad*, and Purchas' *Pilgrims*, including the Embassy of Sir Thomas Roe. The long series of materials thus summarised, beginning with philological inductions and the Vedic hymns, and coming down to the log-books of the East India Company and Bishop of Heber's Journey, cover a period of between three and four thousand years. They enable the English student to obtain a more or less continuous record of man and his environment in India from perhaps nineteen centuries before Christ, to the nineteenth century of our era.

But this vast store of observation represents only what may be called the pre-scientific materials for Indian geography. With the first year of the present century commenced those great series of operations conducted by our Government, on which our present knowledge of India rests. The trigonometrical survey of India practically dates from 1800, and

owed its organisation on an adequate scale to the two illustrious brethren who were then conquering and governing India, and who are known in English history as the Marquess of Wellesley and the Duke of Wellington. Starting from the measurement of an arc of the meridian, the complete triangulation of the Indian continent has been steadily carried out at 3472 stations in spite of malarious forests, tropical swamps, and Himalayan snows. The achievements of daring, and of patient suffering, and of indomitable endurance in the records of the Trigonometrical Survey of India, form some of the most glorious unpublished annals of our British race. While the geodetic measurement of India, as a whole, was thus being accomplished, the Topographical Survey, based upon the trigonometrical triangulation, was filling in the details for each province. Isolated surveyors, among whom Major Rennell in Bengal and Colonel Colin Mackenzie in Southern India hold the foremost place, had been at work since 1762; but the Topographical and Revenue Surveys, on a systematic plan, may also be said to date from the first years of the present century. The trigonometrical and topographical operations of the past eighty-eight years have raised Indian geography into a science. Fourteen centuries ago, the Sanskrit sage, Aryabhata, had affirmed the diurnal revolution of the earth on its axis, explained the true cause of solar and lunar eclipses, and is said to have computed its circumference at the marvellously accurate approximation of 25,080 miles. This was a splendid triumph for Brahman astronomy a thousand years before Copernicus; and Observatories erected, or even conducted, by Indian princes had carried on excellent work before the British established their Indian headquarters of astronomical observation at Madras. The early European voyagers, also, had constructed maps of India and of its ocean approaches before the admirable marine surveys by the old Indian navy. But while acknowledging the historical interest of these pre-existing materials, the fact remains that the scientific geography of India has been created by the British Government and by British officers during the present century.

The accurate basis thus afforded has been used to systematise various cognate departments of knowledge. In 1818 a geologer was regularly attached to the trigonometrical staff, and his office has grown into the great Geological Survey, to which India is deeply indebted for the development of her mineral resources. The physical geography of India was investigated by a series of able workers, conspicuous among whom were the indefatigable brothers, Henry and Richard Strachey. General Richard Strachey has now had the enviable task of giving effect, as President of the Royal Geographical Society, to his ideas regarding the true scope and functions of the science, ideas perhaps formed during his pioneer searches among the Western Himalayas and Siwaliks forty years ago. The botanical geography of India received its first impulse from the *Hortus Malabaricus*, undertaken under the auspices of the Dutch Governor of Malabar, Van Rheede, in the seventeenth century. But the true father of Indian botany was our brother Scotsman, Dr. Roxburgh, who lies buried in this city. His magnificent volumes of the Flora Indica were published from 1820 to 1832. His successor, Nathaniel Wallich, was a

Dane, taken captive by the English at Serampur, but promoted from his prison to the highest botanical appointment in the gift of the Indian Government. Under Dr. Wallich's enthusiastic administration, the Calcutta Gardens soon became the richest horticultural establishment in the tropics, and in many respects the first in the world. Besides travelling and collecting for it, himself, in Nepal, Burma, and the Straits, he employed collectors in all parts of India. The treasures thus obtained were distributed with lavish munificence to the public and private gardens throughout Great Britain, its Colonies, and Europe, whilst he at the same time enriched the Garden at Calcutta by the contributions which were received in return. By the same means he amassed a Herbarium of Indian plants amounting to upwards of 8000 species, named and numbered duplicates of which were distributed to the principal museums of Europe. For extent, novelty, and interest, this great Herbarium has never been equalled. Amongst his many contributions to scientific botany, Dr. Wallich's *Plantæ Asiaticæ Variores*, a superb work in three folio volumes, will always be regarded as a monument of his great botanical knowledge, energy, and ability. Other distinguished botanists succeeded Dr. Wallich, down to the admirable labours of Dr. King. It was, however, reserved for the illustrious son of a distinguished Scottish professor, to complete the work which Dr. Roxburgh began. Sir Joseph Hooker's long labours for India include every branch of botanical research, from his personal collections in the Himalayas forty years ago to his plotting out the Indian continent, with Ceylon, into eighteen botanical provinces, and his great Flora of British India, which will form one of the most enduring monuments of British science. The zoology of India has not yet been systematised by so encyclopædic a genius. But important divisions of the animal kingdom in India have been carefully investigated. A noble and venerable worker, Brian Houghton Hodgson, still remains among us, who combined with a master's grasp alike the botany, the zoology, and the ethnology of Himalayan India. Dr. Blanford's *Fauna of British India* will treat with a magnificent completeness of the Indian Vertebrates. The study of plant life and animal life is now receiving new and invaluable data from the Meteorological Department. India presents an unrivalled area for thermometric and barometric observation; an almost isolated meteorological field of vast size and of comparatively simple conditions.

The interval from plant life and animal life to human life is a wide one; and it has been successfully bridged by the Government surveys in India. Man and his works in the past have been systematically explored by a brilliant succession of archæologists, among whom five Scotsmen stand in the foremost rank. Colebrooke, Colonel Colin Mackenzie, and Buchanan Hamilton, in the beginning of the century; General Sir Alexander Cunningham, a son of our Dumfriesshire poet, and Dr. Burgess of Edinburgh, in our own days—these are the workers to whom India is conspicuously indebted for the exploration of her ancient memorials. The investigations of Colin Mackenzie in Southern India and of Buchanan Hamilton in Bengal form two magnificent series of manuscript folios in the India Office Library. The more extended labours of General

Cunningham, and Dr. Burgess's invaluable researches in the Western Presidency, are printed in the records of the Archæological Survey of India. Together with the works of Colebrooke, Horace Hayman Wilson, Rajendra Lala Mitra, Bhau Daji, and others too numerous to name, they supply accessible and abundant materials for the study of Indian historical man.

This great reservoir of research has contributed invaluable materials to the latest of the Indian Government Surveys—the Statistical Survey of India. The Statistical Survey, after eighteen years of continuous effort, has digested and published a complete account of the country and its people in 128 volumes. Each of the 240 districts of India, as then constituted, is dealt with separately, from materials collected on the spot. The Survey preserves a unity of plan sufficient for the purposes of comparative statistics, without sacrificing local individuality. This long labour, like the Archæological Survey, has also been conducted under the direction of a Scotsman. The physical geography of each district, or territorial unit, its administrative history, its meteorological and climatic conditions, its natural products, mineral, vegetable, and animal, its methods of cultivation, its population and races, their ethnical divisions, their civil status, their rate of increase, their industries, arts, manufactures, commerce, and trade, are systematically set forth in a vast aggregate of sixty thousand printed pages. The Statistical Survey thus endeavours to sum up the practical human aspects of the many series of operations which the British Government has conducted since 1800, with a view to obtaining an accurate knowledge of India. Its dependence upon these operations, and the debt which it owes to them, may be judged from a single fact. During the progress of the Statistical Survey the position of the Madras Observatory, on which all Indian longitudes are based, was determined afresh by the exact methods of electro-telegraphy. It became necessary, therefore, to carefully consider whether the whole longitudes in the Statistical Survey, exceeding ten thousand in number, should be altered accordingly ; or whether, as a further minute change seemed not improbable, the case should be met by a general intimation that all longitudes in the Statistical Survey require a constant correction of minus $2\frac{1}{2}$ minutes. As the Archæological and Geological Surveys complete their work, and as the meteorological observations furnish materials for new inductions, additions and improvements will, I hope, be made in a future edition of the district Statistical Accounts. Meanwhile their sixty thousand pages have been condensed and made available to the public in the fourteen volumes of the Imperial Gazetteer of India.

I think that every British man may look back with a sense of national exultation to what their countrymen in India have accomplished on behalf of human knowledge during the past eighty years. It is impossible to overrate the political benefits which British Rule has during this period conferred on the Indian races : and even those natives of India who are most desirous for a popular development of our Indian system of government are most forward in acknowledging its claims on their loyalty and gratitude. But while we know that we have ruled righteously, our national habit of self-depreciation sometimes leads us to underrate what may be termed the intellectual and scientific aspects of our Indian Government.

The summary which I have given of the actual work done by our countrymen in India during the present century forms an unanswerable protest against such despondency. If the evidence of an independent expert is preserved, let me quote the words in which the great German organ for the criticism of foreign literature sums up its verdict on the Statistical Survey :—"The Englishman who dips, as we have done, into this deep reservoir will be filled with a new and nobler pride in the empire which his nation has created and maintained as their own in the East. Not warlike fame, nor imposing majesty, nor wealth, nor the national power which guarantees the British sovereignty in India, make upon him the strongest impression. It is rather a feeling of the earnest and responsible duty which fate has imposed upon his nation to free India from anarchy and misrule—to make it the England of Asia, and the centre of a new civilisation for the continent from which issued the earliest stream of enlightenment to enrich the world."

I shall now summarise a few of the inductions which may with safety be drawn from this great magazine of research. India was marked out from primæval times as a continent which the races of mankind were destined to reach by three definite routes. The sea-coasts of Lower Bengal, and the comparatively easy approach through its eastern hill-ranges, gave an easy access from the south-east. The evidence proves that in a prehistoric period successive migrations entered India by these routes, and brought with them dialects which, after infinite processes of mutation and decay, still establish their relationship with the human families to which the nations of Eastern Asia, from Burma to China, belong. This advancing tide of races from the south-east was encountered at a very early period by an inflow of population through the mountain passes of the north-west. The huge wall of the Himalayas along the north of India seems to have allowed of little influx from Central Asia. The population of India, like the rivers of India, could only find entrance into the peninsula by skirting round the Himalayas, at the extreme east or the extreme west of that mighty mountain barrier. The tide of non-Aryan mankind flowing up the Gangetic valley from the south-east was eventually encountered by the inundation of Aryan mankind entering the Gangetic valley from the north-west. A process of enslavement or of incorporation took place under Aryan supremacy, but vast masses of the defeated non-Aryans were pushed out of the Gangetic basin into the hills which surround it, and especially into the mountains and table-lands of Central India on the south. But even down to our own century, the south-eastern non-Aryan races kept constantly pushing in from the coast and eastern border of Lower Bengal. The Muhammadans had for a time to fix their military capital of Lower Bengal at Dacca, in the unhealthy eastern delta, to repress these movements. Our first maps of that country delineate large tracts bare of inhabitants, with the words written across them, "depopulated by the Maghs." It was not till the British, in 1824-26, broke the power of Burma, and annexed the eastern province of Assam and the coast of Arakan, that invasions from the south-east ceased out of Indian history.

The third great approach to India was by the sea. The difficulties attending ancient navigation rendered this route an almost inaccessible one for military purposes till about a thousand years ago. From the time of the Roman Empire merchant ships had reached India from the Persian Gulf and Red Sea. But it was not till the religion of Muhammad gave its momentous impulse to the peoples of Arabia, that invasions in force commenced by the sea. From the eighth to the eighteenth centuries of our era, however, such invasions become a historical factor of increasing importance. They led to the formation and to the maintenance of Muhammadan states and kingdoms in Western and South-Western India, which played a decisive *rôle* in the destinies of the whole Indian continent. But for this Muhammadan element in Southern India, the pirate Musalman strongholds on the coast and the strong Musalman monarchies inland, it seems probable that a Hindu race, the Marathas, would at this moment be dividing the sovereignty of the peninsula with the British. During the eighteenth and nineteenth centuries the sea became the great highway for the conquest of India. The two ancient land routes of invasion from the north-west and the south-east are now definitely closed.

The geographical configuration of India had not only defined the three methods by which it should be reached; it had also rigidly prescribed the distribution of the masses of mankind who flowed in. India was marked out by nature for four distinct seats of ancient empire, and for four ancient lands of refuge. The delta and rich lower valleys of the Ganges, like the delta and rich lower valleys of the Nile, seem to have been appointed as a nursery for the human race. Nor can there be any reasonable doubt that Lower Bengal would have become a centre of non-Aryan civilisation, which might have greatly modified our conceptions of the intellectual possibilities of Turanian mankind, if that province had been allowed to work out its own development. But the increasing pressure of the Aryan races from the north interrupted the process. The climatic conditions of Lower Bengal, although favourable to the growth of wealth and the increase of the species, are unfavourable to the physical development of the individual man. When, therefore, wave after wave of hardier tribes poured through the north-western passes from the highlands of Central Asia, and pushed their predecessors down the Gangetic valley, the non-Aryans from the south-east succumbed in the impact of the races.

For, meanwhile, a second great seat of civilisation had established itself in the north. The upper valleys of the Ganges and its affluents, together with the river margins of the Punjab, were marked out not less distinctly than Bengal as a scene for the early progress of mankind. The soil, although less perennially recuperative, was abundantly rich for the wants of a not too dense population. Any inferiority in fertility was compensated by a climate more favourable to robust physical development. From the traditional Indian point of view, the subjugation of the non-Aryan races of the south-east by the Aryan races from the north-west, was final and complete. From the point of view of literary and philosophical culture, the north was also triumphant. The Aryans of the north-west appear as having given their religion, their philosophy, their

poetry to all India. But modern critical research proves that the result was really a coalition rather than a conquest. There are indications that the great Buddhist religion, which dominated India for nearly a thousand years, was the product of the eastern kingdoms of the Gangetic basins rather than the north-western, and that it was profoundly influenced in its political history and its organisation by the non-Aryan races. It is certain that mediæval Hinduism, which succeeded Buddhism, and that the modern Hinduism of our own day, derive their practical structure not less from non-Aryan than from Aryan conceptions and rites.

The third region of India marked out by nature as a seat of early civilisation was the delta of the Indus, and the country around the mouths of the two great rivers, the Tapti and the Narbada, which debouch into the Gulf of Cambay. Geographical configuration had, however, set narrower limits to the primitive progress of mankind in these tracts. The sandy plains of the Indus, and the mountainous background which rises at no great distance inland from the mouths of the Tapti and Narbada, were prohibitive of the vast movements of races to which the broad fertile basin of the Ganges gave free scope. Liability to sea-invasion from Arabia or the Persian Gulf, and to devastations from the pirate strongholds down the Indian coast, contributed, with the silting up of the Gulf of Cambay, to restrict the area of these western maritime seats of Indian civilisation. After figuring prominently during ten centuries, from Alexander the Great's progress through Sind (325 B.C.), to the Buddhist pilgrim's account of the court and kingdom of Valabhi (630-640 A.D.), the kingdoms of the northern Bombay coast were eventually absorbed by the great Muhammadan empire which had its centre in the upper valleys of the Ganges.

The fourth seat of ancient Indian civilisation was marked out with even greater precision. The lofty mountain ranges which run down the south-western coast render it impossible for the drainage of the inner hills and table-lands to find an exit on that side. A narrow fertile strip borders the ocean, but is walled out from the rest of India by the Western Ghâts, or, literally, colossal "landing-stairs" from the sea. The rain which falls upon the peaks overhanging the Bombay sea-board has to search out for itself a course of many hundreds of tortuous miles, till it reaches the Bay of Bengal. In this way, the three great rivers of the Madras Presidency, namely, the Godavari, the Kistna, and the Kaveri rise in the mountain wall which arrests the monsoon rains on the Bombay coast, and they traverse the whole breadth of the central table-land to the eastern shores of India. A series of powerful ancient kingdoms thus arose in the well-watered and comparatively open regions of South-Eastern India, with outliers as far north as the delta of the Mahanadi. They were succeeded from the fourteenth century of our era onwards by a shifting congeries of Muhammadan States, from which the five great Musalman kingdoms in the south stand out pre-eminent. The battle of Talikot in 1565 finally transferred the sovereignty of Southern India from the Hindus to the Muhammadans. But the Muhammadan dynasties of the south were influenced by direct maritime intercourse with the Persian Gulf, and in the end differed pro-

foundly in their political views and religious beliefs from the Musalmans who had entered India by the north-western passes, and founded the great empire of Delhi. To an orthodox Suni emperor of the north, like Aurungzeb, a Shia dynasty in the south was almost as hatefully heretical as were the Hindu infidels themselves. Political expediency combined with religious differences to render the conquest of the Muhammadan kingdoms of the south a necessity for the Muhammadan empire of the north. After a struggle prolonged over more than a century, at the very moment when victory seemed within the grasp of the Delhi sovereign, the geographical barriers fixed by nature between the north and the south decided the fate of Hindustan. The Muhammadan dynasties alike of the north and the south were broken in the conflict, and the Hindu Marathas rushed forth from their mountains, and became for a time the masters of India.

I have mentioned that India was marked out by its physical configuration not only for four separate seats of early empire, but also for four refuge-lands for the defeated races. As successive waves of invaders poured in during three thousand years from the north-west, the early inhabitants were gradually pushed aside to right and left out of the Gangetic basin. Some of them sought shelter in the lower ranges of the Himalayas on the north. Others found new homes amid the mountains and valleys and table-lands of Central India, and there worked out a tribal political organisation of their own. The deserts and oases of Rajputana afforded at a later period a refuge-land to the chivalrous Hindu tribes who disdained to yield to the Muhammadan invader. In Southern India a hardy breed of men grew up among the ranges and highlands which rise from the Bombay coast. This indigent peasantry, bred in the discipline of a scanty soil and a severe husbandry, disclosed in the sixteenth century a capacity for consolidation under military chiefs, and of docile guidance by astute Brahmans imported from the fertile maritime strip which lay between their highlands and the sea. Thus consolidated, they became the Maratha race. The Mughal emperors, in their attempt to conquer the south, had not only to overcome the barriers of desert, and forest, and mountain, but also the indomitable Hindu highlanders. The failure of the Muhammadans in this attempt formed the turning-point of India's history.

At that turning-point my narrative comes to a close. For the history of India during the subsequent period—the period of British rule—ceases to be the history of how the geographical conditions controlled the movements of man. It becomes the record of that series of splendid efforts by which the British rulers, aided by modern science, have overcome the obstacles of nature. Of the three routes of invasion into India, the two land routes from the south-east and north-west have been closed by British rule. The third, or ocean highway, is commanded by British fleets. Even if Russia, or any other power, were now to force an entrance through the north-western passes, she would find on the Indian side of the defiles, not alone the troops of the Bengal provinces, but the array of a politically united India. I believe that she would also encounter another, and in India an altogether new breakwater against

foreign aggression—the loyalty of the Indian races, conciliated and contented under the British sway. For the old barriers set up by nature between the northern and the southern kingdoms of India have been thrown down. North and south have been bound together by the masterful appliances of British rule; by the railway, the steamship, the telegraph, but above all by a strong central government which has the wisdom not to strain too severely the forces of centralisation.

Yet the geographical conditions of ancient India have bequeathed to us the problem which forms the vital Indian question of the close of this century. Will there ever be a united India? German statesmen and German poets down to the past twenty years, were wont to laugh at, or despair of, the idea of a united Germany. One of the greatest of them asserted that there was no such country as Germany, and no such nation as the German nation. There were, he said, a number of separate countries and peoples, divided by their past history, by their present interests, and by their religious views of the future life, who covered a geographical area erroneously called Germany. Now we hear exactly the same things said about India at the present day. The ancient barriers imposed by geographical conditions have left a legacy of disunion to the races and provinces of India. Some able men will tell you that there is no India. They are the men who look to the past. Other able men speak, perhaps too confidently, of a united Indian nation. They are the men who look to the future. The facts and the duties of the present lie between these views. And I esteem myself fortunate, my Lord, in having had an opportunity this evening of explaining the causes which have disunited India in the past, under the presidency of a statesman who has laboured so nobly for the union of all the British dependencies in the future. I for one do not look forward to an India which will be a single State. But I do look forward to an India firmly knit together into a great Empire. For I see an India in which the ancient barriers, that nature had set up against unity, have been thrown down. I see an India in which ample scope is given in each province for the local management of local affairs, yet in which the revenues and the armies of all provinces are available for the political needs and the military defence of the united Indian empire. Above all, I see an India in which the long-divided races are at this moment awakening to the first impulses of a common national life—impulses which have sprung, not from a common resistance to oppression, but from a true sense of united interests under a righteous government, and of united loyalty to a wise and beloved sovereign. Seeing these things in the present—things that were never before seen in India—and knowing how British rule has solved the hard problems of a divided India in the past, I look forward, not without anxiety, but certainly without fear, to the United India of the future.

Before the Address,—

The Right Honourable the Earl of Rosebery, President of the Society, said:—

"Ladies and Gentlemen,—It now falls to my pleasing duty, as President

of this Society, to open its Annual Session; and I think that in performing this duty I may fairly congratulate the Society on the success it has achieved. We have a large working membership, and we give more to our members than, I take it, any other Society of the kind. When you come to consider how great a step that represents, how great a ratio of progress—when we consider the position of Edinburgh to London or to other great metropolitan cities that have Societies of this kind—I think we have reason to congratulate ourselves. After all, the mere formation of a Geographical Society in this part of the world—in Scotland—is a great sign of intellectual progress. A hundred years ago, when Edinburgh was famous for intellect and for brilliancy—famous, perhaps, among all the cities of Europe, such a Society as this would have been only an intellectual name. But now we have extended our sympathies, and though I do not think that Scotland is less brilliant than it was then, yet it is probably less concentrated, and its intellectual focus is not directed merely on Scotland, or the three kingdoms, or on Europe, but spreads itself all over the world at large. Well, I think we have some proof of our enlargement in the history of our own Society. It seems to me only yesterday—only a month or two ago—since I presided in Glasgow at the meeting of our Society, where we were privileged to hear Mr. Stanley—whose slow and painful progress we are at this moment watching with so much vivid interest. I think that is a proof, if any proof were needed, that our sympathies have got larger, that we demand more varied subjects for our intellectual observation, and that a Geographical Society for Scotland is not now a luxury, but almost an intellectual necessity. Well, ladies and gentlemen, if that be so, I am not sure that the prospect for the geographer is altogether a brilliant one. Think how little there is for geography in the sense of the word as we understood it thirty years ago—think how little there is now in the world for geography to explore. There is absolutely no field at all for the human imagination except in the centre of Africa or Tibet. All the rest is more or less explored. Even Africa seems likely to become as familiar to us as a county in Scotland. As to Tibet—we have hopes of Tibet. Those who love the mysterious can always lay their account with Tibet. A climate which preserves libraries for centuries, in which no literary work is ever lost, and where no human being, except perhaps one Hungarian in a century, is ever allowed to penetrate—that is the region which offers some field for the imagination. Now, I am not sure if Sir William Hunter this evening will take us, as the Indian Empire has taken us, to the immediate proximity of Tibet, but he is, as I understand, going to discourse to us on the historical geography of our Indian Empire. That is not a subject on which all of us are qualified to discourse, and I suspect that we all come here to listen to him rather as learners than as critics. But it does suggest this consideration, how far that system of historical geography is likely to extend. Historical geography is, after all, the history of empires; and the history of our Indian Empire is one so extraordinary, so marvellous, sprung from origins so indirect, that we may be inclined to speculate, ourselves, where the historical geography of our Indian Empire may lead us. After all, ladies and gentlemen, our destinies come to us very much in germs—in germs that we do not observe ourselves. The facts that are likely to make or to mar our future are very often absolutely unperceived at the time. And when we remember that it is about three hundred years ago since three Englishmen, almost by chance, landed on the coast of India, and were brutally ill-treated there—and that was perhaps our first acquaintance with our Indian Empire—and when we remember that in three centuries that empire has grown to what it is—has grown to so prodigious a responsibility, that statesmen of the time of

Elizabeth might well have paused to undertake it if they had ever realised what they were about to inaugurate—when we consider that, I say, we may feel the deepest interest in our historical geography, and some perplexity as to the historical geography of our future. Ladies and Gentlemen, that is all I have to say to you on that point, and I have only now to introduce Sir William Hunter to you. I do not know that the word "introduce" is a very felicitous one, because Sir William Hunter is well known to Edinburgh already. It is his rare fortune that, in an early age for statesmen and for public men, he has been the most prolific *littérateur*, perhaps, of his generation. I do not suppose that perhaps anybody except Dumas the novelist, or Rubens the painter, has ever produced as much as Sir William Hunter at the same age. And we have this further pride that, if I am not mistaken—but he is at hand to correct me—if I am not mistaken, these prodigious works of his, the *Imperial Gazetteer* and *Statistical Survey of India*, were carried on in part in this very city of Edinburgh. If we left no proof to the world—no other record of our existence in India—than these works, we should leave something very considerable behind us. And it is as the author of the *Imperial Gazetteer*, as a man who has done almost more work in his time than any other person whom you can lay your hands upon, that I have the greatest pleasure in introducing Sir William Hunter to this audience.

After the Address,—

Professor Butcher, Member of Council, moved a vote of thanks to Sir William Hunter for his Address. He said they had had an exposition from Sir William Hunter that was both popular and scientific in the very highest sense. He thought that all of them, as they listened to the Address, must have wished they had had Sir William Hunter with them in childhood to instruct them in the science of geography. It must also have occurred to them that they had good reason to be proud of being citizens of the British Empire. If they left India to-morrow they should leave behind them a monument of peaceful and beneficent sway.

Sir William Hunter bowed in acknowledgement of the motion.

Mr. Vary Campbell, Advocate, moved a vote of thanks to Lord Rosebery for presiding. He regretted to say that Lord Rosebery was obliged to leave them immediately, as he understood, for that geographic division of Great Britain which was called England, but he was sure they would join with him in conveying to him the one sentiment that he would like to express to him—namely, that they were all proud of him.

The Earl of Rosebery, in reply, said—Ladies and Gentlemen, I am sure I do not deserve your thanks for anything that I have done this evening. I have not been the chairman—I have only been the first pupil here to-night. We have all been pupils, and, I think, delighted pupils. As Professor Butcher has said, I think some of us must have travelled back with regret to the scenes of our childhood, when geography was rather an arid expression to us than any real vivid study. I believe there is even a better method of studying geography, if we had the opportunity, than listening to Sir William Hunter, pleasant as that is—I mean by realising geography by travel. I have been privileged to travel over a great part of the continent—for it is a continent—which he has so eloquently laid before us to-day. There was one expression of Sir William Hunter which drew me back to those travels. He said that the conquests of India had been rather coalitions than conquests. Well, my knowledge of the country of India is infinitesimal as compared to his, but I cannot help remembering

some incidents of those events which make us feel that those coalitions must have been somewhat unpleasant in their nature. Lord Beaconsfield once said that England did not love coalitions, and I am sure that there is no coalition that England would love less than a coalition of the kind described by Sir William Hunter on the frontiers of India. I had the privilege of travelling along the North-West Frontier, and of course it is impertinent for a civilian to speak about such matters, but it did seem as if by great outlay and by consummate skill we had made that frontier so impregnable that we need not dread coalition or conquest. And, ladies and gentlemen, I believe that there is a second barrier not less important than the mountain barrier which we have fortified in the north-west. I believe it lies in the contented populations of India. I am not quite sure that I understood what Sir William Hunter's view was of those populations. He said that the view at the present lay something between the former view and the future view of the nationalities of India. Well, I take it that even now India is populated by nations and creeds so diverse, so different, with limits so sharply fixed, that we cannot in any possible future, in any limited future, look forward to their becoming a homogeneous population. But we can at least effect this—to keep the scales of justice equally between those nationalities and those faiths throughout that mighty continent, which by that accident which after all is only the finger of Providence in history has been intrusted to our charge—to administer that great inheritance impartially, and to raise before any possible invader a second frontier of a contented and intelligent people.

The proceedings then concluded.

IRRIGATION, NATURAL AND ARTIFICIAL, IN SAMARKAND AND BOKHARA.

By Victor Dingelstedt.

Hon. Corr. Mem., Royal Scottish Geographical Society.

Public attention is largely directed just now to the vast and fertile regions of Central Asia. The Russians are endeavouring to reclaim for civilization those ancient historical countries which once were renowned in many branches of useful activity, and which, notwithstanding centuries of decline and many adventitious circumstances, still present a hopeful disposition. The prospect of these praiseworthy efforts to recall into new life the effete Oriental civilization will largely depend, in Central Asia, upon the solution of the physical questions regarding the distribution or *régime* of water-courses. The steppes and valleys in these rainless regions can be made habitable and productive only by the means of sweet water available in abundance, either through natural or artificial *media*. The art of irrigation and drainage thus assumes a position of the most vital importance. The most fertile and best situated part of Central Asia must be doomed to misery and stagnation, as long as there is no canal, which can bring in water for irrigation and drain off the surplus. The first part of the question—that of bringing in the necessary water—is generally easier of solution than the second,—that of leading it off,—

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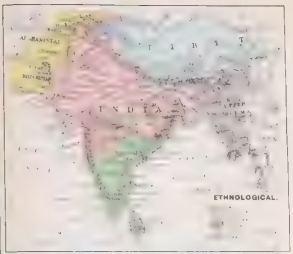
CENTRAL PROVINCES
BERAR
MADRAS
CEYLON

INDIA
PHYSICAL FEATURES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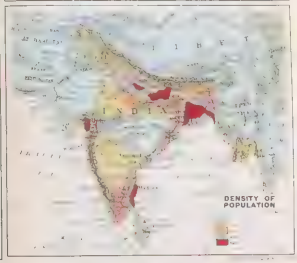
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DENSITY OF POPULATION

where, as in the marshes of Syr-Daria, it is too abundant. Our attention is therefore first claimed by those parts of Central Asia where there are many water-courses, having a sufficient fall to ensure the distribution of the water and to prevent its stagnation. The countries of Central Asia which deserve, from this point of view, the greatest attention, and to which is undoubtedly promised the best future, are the valley of the Upper Syr-Daria, called Naryn, and the valley of Zerafshan. The former, which comprises the greater part of Fergana ("blooming" Fergana—formerly Khokand) lies between 39° and 43° north latitude, between Semiretchinsk, from which it is separated by the Terskeala-tau and Sussam on the north, and the valley of Zerafshan, from which it is separated by the Kashgar-dag and Alai-dag on the south. The valley of Zerafshan contains the province of Samarkand and the semi-independent khanate of Bokhara. Zerafshan is just the kind of river that is needed for irrigation, and if its waters could reach the Amu-Daria it would be the most important affluent of the latter. Starting from the south-western part of Fergana, the oasis of Zerafshan, a name which signifies in Persian "gold-river," stretches in a westerly direction to the lake Denghiz, 20 miles from the Amu-Daria, in about 63° E. longitude. In this paper I shall present to the reader of the *Magazine* some recent data about the discharge of rivers and canals in these cultivated regions of Central Asia; they are gathered from Russian semi-official sources,[1] and, in view of the peculiar character of the countries just mentioned, may be of some interest.

It might be thought that, in consideration of their striking importance, the rivers and canals of Central Asia would often be the object of study. But such is not the case: few investigations have been made, and what is most extraordinary, even the quantity of the supply of what is here the principal source of all riches has remained till quite recently almost unknown.

FERGANA.—A few words about the extent and character of the country before we turn our attention to the principal object of interest. The area of Fergana is estimated at 28,000 square miles, or 17,920,000 acres. The area of lands capable of cultivation is taken to be 2,188,115 acres, or 13 per cent. of the whole; 986,136 acres were actually cultivated in 1885, or 45 per cent. of the available area. The distribution of the different crops on these lands is as follows:—

Cereals (mostly rice),	386,913 acres.
Djugarras (*Holcus sorghum*),	204,833 „
Lucerne,	148,975 „
Cotton,	140,827 „
Vines,	44,434 „
Fruit,	36,785 „
Oil-seeds,	23,369 „

The area of forests is estimated at about one million acres (970,424), or about 6 per cent. of the whole territory. Fir trees occupy 282,085

[1] *Turkestanskia Vedomosti*, 1887, Nos. 35 and 44; 1888, Nos. 5, 6, 13, 14, 15. Middendorf, *Ocherki Fergany*, S. Petersburg, 1887.

acres, or about 29 per cent., of the wooded area, after which the most largely represented species are walnut, pistachio, and a large variety of fruit-trees. It is a mountainous country; on the right or northern side of the Upper Syr-Daria (Naryn) there are the Alexander, Talas, and Chotkal mountain chains, on the left or southern side stretch the mountains of Kashgar and Alaï. The woods occur at a higher altitude on the southern side of Naryn: namely, as high as 10,000 feet, and they are composed chiefly of fir trees; on the northern side the woods are not found at a higher altitude than 5000 to 6000 feet, and are mostly composed of foliage trees. The country is rich in coal mines, which have not, however, been examined at present. The number of inhabitants is estimated at 676,000 souls, out of which 538,800, or about 80 per cent., have fixed places of abode, and 137,200, or 20 per cent., are nomads. The Tajiks, representatives of the former class, are good agriculturists; the Usbegs, forming the majority of the latter, have been shepherds from time immemorial, and still remain averse to agricultural pursuits.

After these preliminary remarks, we may turn our attention to the water-courses—natural and artificial—that intersect the region of the Upper Syr-Daria. These water-courses are more numerous than might be inferred from the extent of the cultivated area, as shown by the numbers quoted above, and it is not the absence of rivers, but the mismanagement of them, and the lack of skill in utilising them, that confines this area within its present bounds. According to the measurements of Mr. Alexander Dmochowsky, executed by order of the Russian Government, the rivers of Fergana, the enumeration of which will follow, carry down on an average about $63\frac{1}{2}$ thousand cubic feet per second. Such a supply of water, rightly distributed by means of a well-devised system of canals, would be considered in Italy as sufficient for the irrigation of $5\frac{1}{2}$ million acres, or almost six times the area it fertilises in Fergana. The principal river here is, of course, the Naryn, as the Upper Syr-Daria is called from its sources to its confluence with the Kara-Daria. The Naryn takes its rise in Jitim-tau, in the mountains of Terskes-ala-tau, at 3786 feet above the level of the sea. It flows in a westerly direction, and down to its junction with the Kara-Daria near the plain of Namangan, which it reaches after forcing a passage through the Sussamir mountains, preserves the character of a mountain stream. It is navigable for rafts laden with fruit, hides, felts, etc. Formerly it was the Kara-Daria that was considered as the true source of the Syr-Daria, but this was a mistake, for the course of the Naryn down to the point of junction is almost double the length of that of the Kara-Daria, and the discharge three times as considerable. All the rivers in Fergana are tributaries of the Naryn and Kara-Daria, and take their rise in the mountains that border this province on the north and south. There are thirteen of these rivers, each of which has a mean annual discharge of over 1600 cubic feet per second, and twenty-six others, each with a discharge of more than 100 cubic feet per second. The list of these rivers is given below, as well as their present mean annual discharge per second, as determined by Mr. Dmochowsky, who has been gauging the rivers and canals of Fergana by order of the Government, during six years, at every season, and has

recently published the results of his labours in the official organ of the Governor-General of Turkestan.[1]

The Rivers of Fergana and their Mean Discharge in Cubic Feet per Second.

(1.) *The District of Osh.* Altitude of the town of Osh, 3559 feet.

The springs in this district give a mean supply of water of about 946 cubic feet per second. The principal canal—Aryk-Savaj—has a discharge of 105 cubic feet.

Rivers—	Cub. ft. per sec.	Torrents—	Cub. ft. per sec.
Tchili,	2244	Tchashma,	265
Kirghis-ata,	2424	Aïr-tash,	185
Akbûra,*	2695	Kokh-djan,	288
Torrents—		Taldyk,	355
Kapka,	250		

* Affluent of Kara-Daria.

(2.) *The District of Andijan.* Altitude of the town of Andijan, 1813 feet.

The springs in this district give a mean supply of about 653 cubic feet per second. There are seventeen canals, with a total discharge of 8718 cubic feet per second. The most important are:—Shaarkhan, 1585 cubic feet per second; Andijan, 1440; Mussulman-Kul, 1245.

Rivers—	Cub. ft. per sec.	Torrents—	Cub. ft. per sec.
Jassy,*	2080	Ungur,	1580
Kara-Kuldja,*	2145	Kugart,	1280
Tar,*	2235	Tchanget,	526
Kurshab,	1945	Ïsky-Massy,	128
		Shaidin,	100
Torrents—		Tash-ptchak,	108
Maïly-sai,	1085	Kara-taryk-sai,	595

* Affluents of Kara-Daria.

(3.) *The District of Marghelan.* Altitude of the town of Marghelan, 1476 feet.

Springs discharge 840 cubic feet per second. Principal canal—Aryk-Ulug-nar—895 cubic feet per second.

Rivers—	Cub. ft. per sec.	Torrents—	Cub. ft. per sec.
Shah-i-man-dar,	1895	Aravan-sai,†	1348
Tsfaïran,*	2457	Kara-sai,	584
		Sary-sai,	974

* The source is in the passage of Kitchi-alai, in the mountains of Thian-Shan, at 10,808 feet above the level of the sea.

† *Sai* or *sû* signifies "water."

[1] *Turkestanskia Vedomosti.*

(4.) *The District of Kokand.* Altitude of the town of Kokand, 1202 feet.

Springs discharge 1662 cubic feet per second. Principal canal—Aryk-Vuadil—285 cubic feet.

Rivers—	Cub. ft. per sec.	Torrents—	Cubic ft. per sec.
Sokh, . . .	3585	Kara-sai, . .	890
Isfara, . . .	2475	Utch-bulag, . .	380
		Ak-tchitchek, . .	156

(5.) *The District of Namangan.* Altitude of the town of Namangan, 1705 feet.

Springs discharge 3348 cubic feet per second. Principal canals—Kara-sû, 1425; Janghi, 515; Shan, 685; Kosh, 95.

Rivers—	Cub. ft. per sec.	Torrents—	Cubic ft. per sec.
Pasha-ata, . .	2894	Gava, . . .	445
Kassan, . . .	1628	Tchadak-sû, . .	160
Torrents—		Babaï-iab, . .	130
Sumsar, . . .	398	Padak, . . .	142
Kokh-Saryk, . .	180	Tchanat, . . .	104

To sum up, we have a total of 63,510 cubic feet per second discharged, on the average, by the rivers, springs, and canals in the five districts constituting the province of Fergana, with the following redistribution in cubic feet per second:—

Districts.	Rivers and Torrents. Cub. ft. per sec.	Springs. Cub. ft. per sec.	Canals. Cub. ft. per sec.
Osh, . . .	8,706	950	105
Andijan, . .	13,807	650	8,718
Marghelan, . .	7,258	840	895
Kokand, . . .	7,486	1,662	285
Namangan, . .	6,081	3,348	2,720
	43,338	7,450	12,723

The district that is richest in water is therefore Andijan, through which runs the Kara-Daria with its tributaries; it has almost twice as much water as the district of Namangan, on the right bank of the Naryn, which, as regards volume of water, comes second. The three remaining districts together receive an almost equal amount of water, with this difference, that Kokand is more abundant in springs, Osh in rivers, and Marghelan in canals, which divert the waters of the rivers.

The above numbers must not, however, be taken too strictly, for independently of the accuracy of the measurements taken by the Russian engineer—which, according to his own avowal, were not always executed

under very favourable circumstances—the number of them, though considerable, and extending over every season during six years, is yet insufficient in such an intricate question to allow of more than an approximate estimate of the annual mean volume of running water to be disposed of.

Most of the rivers in Fergana are perennial, being fed by the snow and glaciers of the mountains in which their sources lie; but their discharge varies considerably according to the season, though we cannot give the exact numbers. The rivers Sohk and Isfara in Kokand, Pasha-ata in Namangan, and Isfaïran in Marghelan are noted for their floods, which in the spring and the autumn increase the volume of water twenty to thirty times the normal outflow. For want of the necessary structures, the surplus of water in times of flood is not stored in tanks, as in Spain and India, but allowed to disperse of itself. In 1833 the damage occasioned by floods to the crops of Kokand was estimated at about £60,000; and in 1886 several districts of Fergana suffered so much from inundation that the Government was obliged to considerably reduce, and even in some cases remit, the taxes. Fields containing 100,000 acres were completely submerged in the districts of Osh, Namangan, and Kokand, and some of the land thus damaged has not yet recovered from the consequences of this disaster: swamps still remain where crops formerly stood.

Though most of the rivers are perennial, their waters do not often fill their true beds, for they are diverted into numerous canals which resemble rivers in all respects, except that they fall more gradually. Their function being not so much to drain the surrounding country as to carry off the water which descends from the snow-clad mountains, the rivers in Central Asia differ from the rivers in Europe, where rain is far more abundant; they draw a large volume of water from the more precipitous mountain regions; on descending into the plains they break up into branches or canals, and continue to be thus subdivided more and more, so as to form small irrigating canals with a scarcely perceptible fall.

The irrigated strip of land stretches along the left bank of the Kara-Daria without interruption from Bich-aryk (*aryk* signifies canal) through Marghelan and Assake to Osh, embracing Charikhana and Andijan. On the right bank of the same river, towards the Naryn on the north, there are two principal groups of irrigated lands, viz., (1) *Teki-sû-arasi* (*sû*—torrent or small river; *ieki*—two, and *arasi*—between), between the Kara-Daria and Naryn; and (2) *Utch-kurgan*, with Naûkat or Isfara in the district of Kokand. The canals in Fergana are mostly of ancient origin; they exhibit sometimes triumphs of engineering skill, the more to be admired that their constructors were totally deficient in the knowledge we owe to the researches of such men as Leonardo da Vinci, Castelly, Guglielmini, Mariot, Lombardini, and a whole host of modern names famous in pure and applied science. The breadth of the canals is from 15 to 20 feet; their gradient from 0·0005 to 0·0004; their discharge, as we have noted, varies from 1585 down to 85 cubic feet per second.

There are but few canals which have regular intakes, as, for instance, the Shaarkan and Ulugnar. The canals are connected with the rivers

by means of simple weirs made of ordinary materials, such as mud, sand, gravel, willow branches, and occasionally stones. There is no general plan adopted with the view of irrigating the largest space possible; the canals are too numerous, and there is too much capriciousness in their arrangement. The central part of Fergana is still a desert (*Khaderwish*); some efforts which have been made to bring water to it by means of a canal (*Ulugnar*) have failed, but are not yet abandoned, thanks to private enterprise. The canals are administered by elders (*aryk-ak-sakal*—"canal white-beards"), elected by the community under the supervision of a Russian officer. There are, unhappily, no strict regulations and definite laws concerning property in, or control and use of, the water supply, and there is a large scope for the exercise of discretion, arbitrary conduct, and abuse. Ancient laws and customs, never clearly determined, are dying away without being replaced by new ones; and, where they still remain in force, they do not meet the new wants under changed circumstances. The maintenance of the canals, their periodical clearance from silt, which is abundant, and the general management of the whole complicated system, leave much to be desired; confidence in progress, and the necessary money for realising it, are still wanting, and, as a general result of this state of things, there is, notwithstanding the goodwill of the Government, but a slow accession to the area which benefits by irrigation. This will probably continue till the network of canals is reconstructed according to sounder principles, and a total revision of, and radical reform is made in, the laws and customs—now out of date and generally disregarded—which regulate the water supply.

Zerafshan (in ancient times Sogo and Polytimetus).—Zerafshan signifies in Persian "that which spreads gold," and the river well deserves its name by the wealth of water, more precious than gold, which it diffuses through the fields by numerous canals. The total length of the river from its sources to the lakes, where it loses itself, is estimated at about 426 miles; of which the upper part for 286 miles belongs to Russian Turkestan, and the remaining or lower part to Bokhara. The basin which the river drains is estimated at about 14,375 square miles, of which 7285 square miles are level, and 7090 square miles are mountainous country, where the river excavates a deep channel, extracting the fertilising material which so much enhances its value. The source of the Zerafshan is in the glacier Kock-sû in the Alaï-tau, at 8500 feet above the level of the sea, and the river is known in its upper course, till it reaches the lake Iskander-göl above Obburdan, at an altitude of about 6560 feet, under the name of Matcha, or Kohik. Then it runs almost parallel to the 40th meridian of east longitude, through a narrow and profound gorge, which expands into a valley near the town of Pendjakent, at an altitude of 3200 feet, 156 miles from the source of the river. The breadth of this upper valley of Zerafshan from Iskander-göl to Pendjakent is from 10 to 45 miles; its fall is variable, as follows:—from 0·003 (the upper 30 miles) and 0·004 (the last 26 miles above Pendjakent) to 0·0075 along the whole middle course of this mountainous part of the river, extending about 100 miles, from Paldarak

through Obburdan to Dasht-kâsy. The mean fall of the mountainous course of the river from its sources to Pendjakent is therefore about 33 feet per mile, or 0·006 of the length. The affluents of the Zerafshan in this upper region are numerous, but mostly insignificant. The principal tributaries on the left side, which drain the northern slope of the Zerafshan range, are the Fan, the Kshtût, and the Maghian. On the right bank of the river there are only small rivulets, which drain the southern slope of the Turkestan range, but become destructive torrents after heavy rains. In its further course from Pendjakent to the plain the Zerafshan runs for about 257 miles through a large valley, which is bordered on the north by the mountains Tchumkar, Nurat, Kara-tau, and Ak-tau, and on the south by the Shakhrisab range. Here the bed of the river has a mean fall of about ten feet per mile, or 0·0019 of the length. The river has no regular tributaries from Pendjakent down to the lakes, where it is lost. It is swollen occasionally, only in the spring, by rain torrents. Some distance above Samarkand the river divides into two branches, the Ak-Daria and the Kara-Daria, which reunite about thirteen miles below the town, near the frontier of Bokhara. Here is the intake of the principal Bokharian canal, the Karaman, which conducts away the greater part of the water, which remains in the river after it has fed all the numerous canals in Russian Turkestan. During the rest of its course, the river continually decreases in bulk, in consequence of the numerous canals which issue from it on its right and left banks alternately, and runs for about eighty miles, preserving the name of Zerafshan ; but at Du-aba ("Two Waters"), the greater part of its water is diverted into the canal called Shah-rûd, and the little that remains of the Zerafshan runs under the name of Karakûl for about sixty-two miles in the direction of the town of Karakûl. Two miles above this town the river breaks up into two arms, the Karakûl and the Taghy-kyr. Some twenty miles before reaching the Amu-Daria, the now nearly exhausted, but still muddy, waters of the Zerafshan flow into the marshy lakes of Denghis, Sunghur, and Karanga, which have no outlet.

The function of the Zerafshan being twofold—to drain the territory it traverses, as well as to spread over it the waters it receives from the higher snow-regions—the question of the volume of water the river carries down through the year acquires exceptional importance. The level of the water in the Zerafshan is variable ; it is lowest during winter and highest in July, the volumes in the two cases being as 1 : 20. The minimum discharge in December, January, and February is estimated at 1000 to 1300 cubic feet per second ; in March the snow in the lower reaches of the river begins to melt, rain falls, and in the middle of April the discharge is three times as considerable as in the preceding months. This increase of volume continues steadily, with but short interruptions, till the middle of July, thanks to the continued thaw of the abundant snow on the mountains. After having thus reached the highest limit—in the seasons of the year when there is greatest need of irrigation—the river begins quietly to subside, and reaches its minimum in autumn, with casual variations, due to the rain, which, although generally scarce, is most abundant at this season. According to the measurements

carried out at Dupul, ten and a half miles above Pendjakent, by M. Shijemsky, for the Russian government, the mean annual discharge of the Zerafshan is estimated at 8764 cubic feet per second. This is the mean discharge of the Adda in Italy. The mean monthly discharges are given in the following table :—

Months.	Mean Discharge in cubic ft. per 1″.	Months.	Mean Discharge in cubic ft. per 1″.
January,	1,120	July,	21,950
February,	1,400	August,	17,490
March,	2,130	September,	12,890
April,	5,590	October,	6,415
May,	10,900	November,	3,770
June,	19,220	December,	2,300
		Total,	105,175

The mean discharge of the river for the summer half-year is 14,810, and for the winter half-year 2718, cubic feet per second. This volume of water is employed in the irrigation of an area of about 287 square miles, of which about 115 square miles are in the province of Samarkand and 172 square miles in the khanate of Bokhara. As irrigation is necessary only in the warm season, we may consider that a mean discharge of one cubic foot per second fertilises about 12·4 acres in the year. This is little in comparison with the service obtained from the same unit of water in Spain, Italy, or in India, where the irrigation is conducted with far greater scientific knowledge. As Samarkand would naturally receive more than its share of the water of the Zerafshan, owing to its more even surface, irrigation works are more numerous in Bokhara.

I shall now enter into some particulars about the way in which the water of the Zerafshan is actually distributed, or, in other words, about the canals which perform the work of distribution. There are altogether 126 canals, which have their intakes from the Zerafshan, of which 83 take their supply from the river in the province of Samarkand, and 43 in the khanate of Bokhara. The entire length of these principal canals, excluding the smaller irrigating channels, cannot be less than 200 miles. The chief small canals are conducted from the Zerafshan some six miles above Pendjakent, near the village Sudjina. The chief larger canals flow from the river, on its right bank, about eight miles below Pendjakent, and on its left bank two miles further down. The most important canals are the Tuïa-Tartar and Bulungar on the right, the Kasam and Dargam on the left, bank of the river. The canals immediately connected with the river serve to feed a number of secondary canals, which conduct water to single villages and estival stations. The total number of such secondary canals in the province of Samarkand alone is not less than 1000; their total length amounts to several hundred miles. The canals are not straight, but, as if in imitation of the river, sinuous and meandering; they often form ravines and gullies, and generally occupy far more space than is absolutely necessary to conduct water. The canals are traced so irregularly as to leave considerable

intervening tracts, to which the water cannot be brought, but which it should not be difficult to irrigate, by making a better use of the declivities of the ground. These remarks apply indifferently both to the canals in Samarkand and Bokhara; but whilst in the former province a greater general inclination of the surface permits the surplus water to return to the river after its work is done, in Bokhara, which is flatter, many of the canals form extensive swamps, very prejudicial to the salubrity of the air, because they are unable to carry away or otherwise dispose of the water which drains off the irrigated fields. Each canal connected with the river has to irrigate a separate oasis, but the whole area in Zerafshan subject to irrigation is divided into nine groups of oases or sections, three in the province of Samarkand, and six in Bokhara. We shall deal first with Samarkand:—(1) The uppermost section of the irrigated area in Zerafshan extends from the upper intake of the Sudjina to the point where the river divides into two branches, called respectively Ak-Daria and Kara-Daria; it is 50 miles long, and has a mean fall of 0·0036; (2) section of the Ak-daria, 67 miles long, and with a mean fall of 0·0026; (3) section of the Kara-Daria, 64 miles long, with a rather greater mean inclination of 0·0027. There are 29 canals in the uppermost section, with a total discharge during the period of floods of about 9200 cubic feet per second; in the Ak-Daria section there are 24 canals, with a discharge, in the same season of the year, of only 2470 cubic feet per second; in the Kara-Daria section 30 canals, with a maximum discharge of 7065 cubic feet per second, making a total of 83 canals, with a discharge of 18,735 cubic feet per second, or about 0·85 of the mean maximum discharge of the Zerafshan in July. This large distribution of water by all these 83 canals, which act simultaneously, is maintained during 20 to 27 days, and serves to water about 697,900 acres of cultivated land. With this area, then, and the total discharge of all the canals (18,735 cubic feet per second), we find there is rather less than 38 acres to one cubic foot of water. Taking the mean for the whole season during which irrigation is carried on, we have one cubic foot per second to about 47 acres. In India, according to Moncrieff, a supply of one cubic foot per second serves for the irrigation of as much as 250 acres, and in Italy, according to the same authority, this quantity of water suffices for 87 acres and more.[1] During spring—that is, in April and May—when the mean discharge of the Zerafshan is about 8720 cubic feet per second, all the water of the river is directed into the canals of the first section, whilst the two remaining sections and those of Bokhara have to be content with the water that flows back into the river after having done its work, in addition to that which, produced by rain and melting snow, descends from the mountains in torrents. It is calculated that the quantity of water brought to the fields by spring torrents, and collected by canals, makes up about 20 per cent. of the discharge of the river at this season. This water is considered sufficient for the first irrigation of the crops, and it even leaves a small surplus, which accumulates in the marshy lakes below Karakul.[2] The irrigated

[1] C. C. Scott Moncrieff, *Irrigation in Southern Europe*, p. 104.

[2] Denghis, Sunghur-göl, and Káranga-göl.

land in the province of Samarkand is planted with the following different kinds of crops:—

Cereals, . . .	0·40
Djugarras, . . .	0·29
Rice, . . .	0·13
Gardens, . . .	0·12
Cotton, . . .	0·06
	1·00

We will now turn to BOKHARA. The 43 canals which here tap the river of Zerafshan have a total length of not less than 600 miles. Their breadth varies from 6 to 60 feet; they distribute in summer what is left in the Zerafshan by the numerous canals of Samarkand, with an additional supply derived from rain and melted snow, which may be estimated at some 8000 to 10,000 cubic feet per second. The general mean fall of the bed of the Zerafshan in Bokhara is about 4·8 feet per mile, or 0·0009. The canals in Bokhara may be divided, as stated above, into six groups:—1. The Nakhrpai or Narupai canal, which starts from the Kara-Daria in the Russian territory; its intake is above Katta-Kurgan, its length is 62 miles, its breadth on the Russian-Bokharan frontier is 52 feet, and its estival discharge about 1167 cubic feet per second. The network of irrigating canals that are fed by the Nakhrpai covers an area of 207 square miles. 2. Three canals draw their water from the Ak-Daria, also in Russian territory, viz. the Shabat, Toss, and Damy-Ghipan; their total length is 82 miles, their estival discharge 617 cubic feet per second, and the area irrigated by them 40 square miles. 3. Twenty-five canals begin above Du-aba, some on the left, but most on the right, bank of the Zerafshan; their total length is about 340 miles, their discharge in summer is 3814 cubic feet per second, and the area irrigated by them is 248 square miles. 4. The network of canals, starting from the lower course of the Zerafshan, from Du-aba, 77 miles below the present Russian frontier,—hence called Shah-rûd. The river, 29 miles long, has here a mean fall of 0·00054, and feeds 275 canals. The total length of these canals is more than a hundred miles, their discharge in summer about 1612 cubic feet per second, and the area irrigated is 374 square miles. Among these numerous canals in Shah-rûd there are two, the Ukhary-Aylau and the Sary-Djui, which conduct the water to Syr-abat, the railway station for Bokhara. 5. The system of canals on the Vauf-kent or Rud-od, the right arm of the Zerafshan, which branches off from the main river by the village Sandkent, above the bridge Ishan, and carries off a quarter of the total discharge of the river at the point of junction. There are seven canals on the Vauf-kent; their total length is 74 miles, their summer discharge is 583 cubic feet per second, and the area irrigated is 73 square miles, at least. 6. The canals on the Karakul-Daria, also a branch of the Zerafshan, which leaves the main stream (Shah-rûd) at Du-aba, where a weir is constructed to prevent the escape of water into that channel. The Karakul-Daria as a rule is dry, but it serves occasionally as a recipient for the water escaping from the irrigated oasis of

Shah-rûd, and for that of the Shah-rûd canal itself, when the weir, as is often the case, gives way. The total length of the Karakul-Daria is 62 miles. Two miles above the town of Karakul, the river divides into two arms : the right arm, the Khak-kul, which irrigates the oasis Karakul, and supplies water to the railway station Ïlat, and the left arm, the Taghy-kyr, which irrigates the oasis of the same name, and then descends into the marshy lake of Denghis. Three canals, which have their intakes on the Karakul-Daria, have a total length of 20 miles, and a very variable discharge.

To sum up, there are in Zerafshan 126 principal, and 940 distributing, canals, with a total length of not less than 2000 miles, occupying an area of not less than five thousand acres, and serving to irrigate an area of about 2758 square miles, or something less than 0·4 of the basin drained by the Zerafshan, which, as stated above, is estimated aproximatively at 7285 square miles.

The construction of canals in Zerafshan, though not without some boldness both in design and execution, is generally defective ; the canals are tortuous, too numerous, and liable to burst and overflow. The intakes of the canals are simple cuttings in the banks, dammed up occasionally by very unsubstantial weirs of any fragile material near at hand. The cleaning and the general maintenance of the canals is most unsatisfactory, as they are allowed to be obstructed by rubbish of every kind. The environs of Bokhara are so unhealthy, in consequence of the bad air that emanates from the foul water of the canals, that in choosing the site for the Bokhara railway station, the constructors could not find a suitable position within nine miles of the town. The whole system of irrigation is a very primitive one ; all the constructions to raise, dam, let out, carry, distribute, and gauge, the water are of the most simple description, and are built of materials close at hand, such as earth, fascines, stakes, branches, sand, gravel, and sometimes rough stones. The administration of the canals in Samarkand lies, as a rule, in the hands of deputies chosen by the people. There are many abuses, which the Russian Government is endeavouring to remove, but the whole question has proved as yet too complicated and delicate to be dealt with satisfactorily. As regards the administration of natural as well as artificial water-courses in Bokhara, it is, notwithstanding the vital importance of water to the land, quite deplorable. Not only are ability and knowledge wanting, but, what is worse, there are many persons interested, rather than otherwise, in retaining abuses and disorder, these being elements highly favourable to the exercise of arbitrary power. At the head of the water administration in Bokhara is placed the *mirab* (water-chief), a powerful personage chosen by the Emir himself from his immediate followers, against whose decision there is no legal appeal whatever. The *mirab* acts through *pendjabeghs*, authorised to give orders in his name, and chosen out of the members of his own family. The people are represented by *arbobs* and their assistants (*djumban*), which are deputed by the proprietors of the soil (or rather occupiers, for there is no private property in land in Bokhara) to defend the interests of cultivators. In reality these deputies are simply tools in the hands of the administration ; they are constrained to execute the

orders of the *mirab* and his assistants, and it is only by means of bribery and astuteness that they can succeed in serving their constituents. For the purpose of dredging, and other regular canal work, each principal canal has a number of workmen, differing according to its dimensions and importance, assigned to it, which the *arbobs* have to raise among the people at the bidding of the *pendjabegh*. In exceptional circumstances —as, for instance, when some locality is flooded, or a weir has given way —the Emir has always the right, at the recommendation of his *mirab*, to order what is called a *mardy-valiat*—an appointment of supernumerary workmen from outlying districts. The workmen do not receive any pay or renumeration from the State ; it is one of the regular burdens to which they are subjected, and the community has to pay an indemnity in money for any deficiency in the appointed number of workmen. This indemnity is paid to the treasury in the case of the *mardy-valiat*, but in other cases it is placed at the *mirab's* disposal under the name of *backy-pully*. It is asserted that the *mirab* not seldom prefers a backy-pully, which he can pocket, to the work of the labourers.

There is of course an essential difference between the systems of irrigation in the provinces of Samarkand and the khanate of Bokhara. In the former, constant, though not always successful, efforts are made to extend the irrigation, and to prevent waste ; there is greater abundance of water, greater facilities for its conduction on account of the slope of the country, and undoubted advantages in geographical position, whilst in Bokhara abuse reigns supreme, and the deficiency in fall, as well as dependence on authorities outside the country, places this work in a condition which cannot but tell in a highly unfavourable manner on the state of agriculture and on the sanitary conditions of the country in general. This deplorable state of things will probably endure as long as the present despotic administration endures.

Central Asia shows evident signs of awakening from the long slumber in which it has been buried since the times of the immediate successors of the great Mughal conqueror; but one must not be too sanguine as to an early and successful solution of this highly important and complicated question of irrigation, which affects in an almost equal degree the agriculture, the finances, the civilisation, and the salubrity of the country. There can be no doubt, however, that under Russian rule, with increased security and better means of communication, the area of irrigated lands will go on increasing, the laws governing the use of water gain in precision, and that arbitrariness and abuse, which still find so large a scope, will decrease correspondingly. The realisation of such expectations, the problem being a technical and financial one, will of course largely depend upon the measure of confidence which the new state of things in Central Asia may inspire in Russian and European capitalists and contractors. There are already some favourable signs of increased confidence, and, for our part, we see no serious reasons why this confidence should not be bestowed in a fuller measure at this time, when peace, though costly to maintain, is yet in no great danger, and when no serious doubts can be entertained as to the peaceful tendency of Russian rule.

REPORT TO COUNCIL.

By Hugh Robert Mill, D.Sc., F.R.S.E.,

Delegate to the Bath Meeting of the British Association, 1888.

Gentlemen,—I have the honour of submitting a report of the meeting of the British Association for the Advancement of Science held at Bath from September 5th to 12th, 1888, at which I was present as your Delegate to the Conference of Corresponding Societies. This Conference has now acquired a recognised position in the organisation of the British Association, and at the Bath meeting received additional powers which add to its usefulness. Efforts are being made by its managing committee to include all the publishing Societies which can be induced to join. One important result of this will be to obtain a bibliography of the scientific papers published outside the official organs of the great scientific Societies, a class of literature that would otherwise be easily lost sight of, to the inconvenience and loss of future workers in many departments. This has, of course, no bearing on your Society, and one or two of the other leading Societies represented at the Conference, whose publications are recognised as authoritative.

I attended both the Conferences of the delegates, and took part in the proceedings. The first, presided over by Dr. John Evans, F.R.S., was mainly occupied by a discussion of the working of the Ancient Monuments Act and with proposals for the survey of the country for unrecorded prehistoric remains and the mapping of these on a uniform plan. General Pitt Rivers and Sir John Lubbock warmly supported a proposal that the local Societies of the United Kingdom should, on their own authority, undertake to approach proprietors on whose estates such monuments were liable to be injured or removed, and induce them to take proper precautions. It seems to me that the influential position in Scotland occupied by your Society eminently fits it to take action in this matter, and that the sub-committee of Council appointed after my report last year should be continued to consider what can be done in this way.

At the second conference various matters remitted from the sectional committees were considered. Much interest was taken in the report of the committee on the Surface Temperature of Rivers, etc., which was at work last year on several of the streams of Scotland, and on the motion of your delegate several of the English and Irish Societies professed themselves as ready to take up the work in their localities, a proceeding which can hardly fail to result in a great increase of our knowledge of the phenomena of river temperature. This is a novel research in physical geography, which, by the aid of the Associated Societies, may be extended widely and carried on more completely and economically than by any other means which is apparent at present. The committee is a direct outcome of the part taken by the Royal Scottish Geographical Society on the Conference. Amongst other matters brought up was a proposal that photographs of interesting geological sections should be obtained wherever such sections may be found, and that the sections be reproduced in a uniform manner for ready comparison.

The number of delegates present was 35, representing 35 societies or associations of societies, as against 32 delegates from 33 societies last year.

As your Secretary was present at the meeting in his official capacity, and secured many of the more important papers for the *Magazine*, it is unnecessary for me to enter in any detail into the proceedings of Section E. I therefore content myself with the following record of the papers submitted to the Section, many of which were interesting, although few had striking novelty or exceptional importance. The address of the President was of special value at the present time, showing by the history of past changes the importance of present trade routes, and the probable alterations which will follow in the near future. He strongly urged the importance of increased attention to Commercial Geography in education. Captain Elwes' paper describing a new route from India to Tibet, Mr. Dennet's on Explorations in Kakongo, and Mr. Barrington d'Almeida's on the interesting little Malayan State of Pahang were among the freshest records of travel communicated to the meeting. Colonel Bolland sent a very interesting account of the processes of engraving the Ordnance Survey maps, and Mr. H. J. Mackinder raised several questions of geographical nomenclature that promise to lead, through further discussion and deliberation, to some much-needed reforms and improvements.

Section E.—Geography.

President.—Colonel Sir C. W. Wilson, R.E.,K.C.B., K.C.M.G.,D.C.L., F.R.S., F.R.G.S.

Vice-Presidents.—E. Delmar Morgan, F.R.G.S. ; H. W. Bates, F.R.S. ; Sir Lambert Playfair, K.C.M.G. ; Lieutenant-General Richard Strachey, R.E., F.R.S. ; General J. T. Walker, C.B., R.E., F.R.S.

Secretaries.—J. S. Keltie, F.R.G.S. ; H. J. Mackinder, M.A., F.R.G.S. ; E. G. Ravenstein, F.R.G.S. (*Recorder*).

Committee.—Rev. C. D. Ginsburg, D.C.L., LL.D. ; Admiral Sir Erasmus Ommanney, C.B., F.R.S. ; Professor Baron F. von Richthofen ; General Sir H. E. L. Thuiller, R.A., C.S.I., F.R.S. ; Coutts Trotter ; the Right. Rev. the Lord Bishop of Bath and Wells ; Professor W. Boyd Dawkins, F.R.S. ; the Hon. George Brodrick ; The Very Rev. E. H. Plumptre, D.D., Dean of Wells ; Rev. H. B. Tristram, D.D., F.R.S., Canon of Durham ; A. Silva White, F.R.S.E. ; Cope Whitehouse, M.A. ; Colonel Woodthorpe, R.E. ; C. E. D. Black ; Rev. Canon A. J. Carver, D.D.

Delegate Members.—F. J. Faraday ; H. R. Mill, D.Sc.

Papers Read on Thursday, September 6th, 1888.

1. The President's Address.
2. Le Canal de Panama, par M. de Lesseps (read, in M. de Lesseps' absence, by Mr. H. J. Mackinder).
3. Meteorological conditions of the Red Sea (communicated by Lieutenant-General Strachey, Chairman Meteorological Council).
4. Sea Temperatures in the neighbourhood of Cape Guardafui (by the same).
5. *Dr. H. R. Mill.*—Salinity of the Clyde Sea-Area.

6. *Dr. H. R. Mill.*—Ocean Temperatures on the Continental Shelf.
7. *H. W. Clayden, M.A.*—Perspective Maps and Common Maps.
8. *Delmar Morgan.*—Little Russia.
9. *Admiral Sir Erasmus Ommanney.*—Report of a Committee appointed for the purpose of drawing attention to the desirability of prosecuting further research in the Antarctic Regions.

Papers Read on Friday, September 7th, 1888.

1. *Colonel Woodthorpe, R.E.*—Explorations on the Chindwin.
2. *Captain W. J. Elwes.*—A New Route from India to Tibet.
3. *E. Delmar Morgan.*—Russian Topographical Surveys.
4. *Rev. Henry George Tomkins.*—Notes on the Geography of the region from the Nile to the Euphrates, as known to the Ancient Egyptians.
5. *Major Conder, R.E.*—Remarks on Mr. Tomkins's Paper.
6. *Captain A. M. Mantell, R.E.*—Recent Explorations East of the Jordan.
7. *George St. Clair, F.G.S.*—Jerusalem : Nehemiah's Wall and the Royal Sepulchres.

Papers Read on Monday, September 10th, 1888.

1. *Sir Lambert Playfair.*—Tunis as a French Protectorate.
2. *Sir Francis De Winton.*—The Commercial Future of Central Africa.
3. *Rev. John Mackenzie.*—Bechuanaland and the Land of Ophir.
4. *P. H. Ford.*—The Transvaal, or South African Republic.
5. *H. H. Johnston.*—The Cameroons.
6. *E. G. Ravenstein.*—Dr. Livingstone and Bangweolo.
7. *Joseph Thomson.*—Notes from the Atlas Mountains (read by one of the Secretaries).
8. *R. G. Haliburton.*—Akkas and Dwarfs in Southern Marocco.
9. *R. E. Dennett.*—Through Kakongo.

Papers Read on Tuesday, September 11th, 1888.

1. *Colonel J. H. Bolland, R.E.*—Photographic and Photozincographic processes employed in the Ordnance Survey (read by the President).
2. *H. J. Mackinder, M.A.*—Note on Geographical Terminology.
3. *Cope Whitehouse, M.A.*—The River of Joseph, the Fayum and Raiyan Basins.
4. *Captain Conyers Surtees.*—A Mission to El-Wedj.
5. *G. K. Gilbert.*—Notes on Maps produced by the United States Geographical and Geological Survey.
6. *W. Barrington d'Almeida.*—On Pahang, an independent State in the Malayan Peninsula.
7. *George Taylor.*—Formosa : characteristic traits of the Island and its aboriginal inhabitants (read by Mr. Mackinder).
8. *Cesare Tondini de Quarenghi.*—On the general adoption of the Gregorian Calendar in relation with that of the universal hour.

The sections were rather less crowded with papers than usual, and the arrangements for reading them were consequently more satisfactory to the authors. The necessity of a change in the system of sitting continuously from eleven to three was more apparent than ever; in fact the

Geographical Section had on one occasion to adjourn for half-an-hour at one o'clock, as there was no audience.

Many papers of much geographical interest were presented to Section H, Anthropology, and the substance of some of these will probably appear as *Notes* in the Magazine. In Section G, Mechanical Science, a most interesting account was given by Mr. J. Wolfe Barry of the new dock and railways constructed at Barry Island on the Bristol Channel to serve as an outlet for the South Wales collieries. The whole project is a commercial application of geographical principles which determined the site and approaches of the new dock as more favourable than those of the docks of Cardiff both for access to the coal mines and to the open sea. A Saturday excursion of over 100 members of the Association to the Docks, which will be opened for shipping next year, gave a very vivid impression of the manner in which engineering skill had taken advantage of the configuration of land and sea-margin in arranging the basins and railways. Beautiful weather and the hospitality of the directors of the dock company combined to heighten the pleasure of this visit of inspection.

In Section A, Mathematics and Physics, there were several papers of geographical importance including some valuable advances in our knowledge of tropical hurricanes, with new rules for handling ships in cyclones, by Hon. Ralph Abercromby, and an interesting account of the magnetic survey of Japan, by Professor Cargill G. Knott of Tokyo.

In a joint-meeting of Sections C and D, Geology and Biology, a discussion on Coral Reefs was announced; but although a number of speakers took part in the meeting, following up a paper on the origin of coral islands, by Dr. Hickson of Oxford, there was practically no difference of opinion expressed. The applicability of Mr. Murray's theory was generally recognised, although some doubt was expressed as to the power of solution in hollowing out lagoons; and it was generally held that the new view did not exclude the possibility of Darwin's explanation in particular cases.

The following 17 money grants, amounting to £1163, made to committees for carrying on special researches of a more or less geographical nature were passed by the general committee; the total number of grants was 37 and the sum given £1645, representing rather more than the profits made by the Association on the sale of tickets for this meeting :—

Mathematics and Physics.—Ben Nevis Observatory, £50; Measurement of Solar Radiation, £10; A Differential Gravity Meter, £10; Seasonal Variations of Temperature in Lakes, Rivers, and Estuaries, £30.

Geology.—Erratic Blocks, £10; Volcanic Phenomena of Japan, £25; Volcanic Phenomena of Vesuvius, £20.

Biology.—Zoology and Botany of the West India Islands, £100; Marine Biological Association, Plymouth, £200; Flora of China, £25; Naples Zoological Station, £100; Natural History of the Friendly Islands, £100.

Geography.—Geography and Geology of the Atlas Ranges, £100.

Mechanical Science.—Investigation of Estuaries by means of Models, £100.

Anthropology.—North-Western Tribes of Canada, £150; Exploration of Roman Baths at Bath, £100; Characteristics of Nomad Tribes of Asia Minor, £30.

The Bath meeting of the Association evidently taxed the resources of the city to the utmost, but, the numbers attending being considerably under the average, the consequences were not so much felt as might have been expected.

A word of praise must be given to the admirable *Handbook to Bath*, a well-edited collection of well-written accounts of the chief features of interest, mainly archæological, in the neighbourhood. It is illustrated by a handsome geological map printed in colours by Messrs. Gall and Inglis, Edinburgh.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Annual Business Meeting of the Society was held in Dowell's Hall, Edinburgh, on the afternoon of the 5th November—Mr. James Currie in the Chair. The Annual Report of Council, which is published this month, was submitted by the Secretary, and, on the motion of Mr. William C. Smith, was adopted by the Society. The following Resolution, on the motion of Mr. J. G. Bartholomew, was adopted by the Society :—

"That the President and Vice-Presidents be re-elected for the current Session.

"That the Honorary Secretaries, Treasurers, and Map-Curator be re-elected.

"That Professor James Geikie be elected Honorary Editor in place of Mr. Hugh A. Webster, resigned; and that Mr. John Gunn be elected Honorary Librarian in place of Mr. David Petrie, deceased.

"That in the room of Members of Council retiring at this time by rotation, the following gentlemen be elected Members of Council, namely :—Dr. Bruce Bremner; Professor Butcher; Captain Dunlop, R.N.; Henry Goudy, Esq., Advocate; David Guthrie, Esq., Glasgow; William Jolly, Esq., Glasgow; Christopher Salvesen, Esq.; and Professor Wallace. And that the following Members of Council retiring by rotation be re-elected, namely :—W. Scott Dalgleish, Esq.; Edward Cox, Esq., Dundee; Sir Alexander Christison; Colonel Dods; Dr. R. W. Felkin; Rev. George A. Smith, Aberdeen; David Stewart, Esq., Aberdeen; W. Renny Watson, Esq., Glasgow; James Stevenson, Esq., Largs; Coutts Trotter, Esq.; Dr. George Smith; and Robert Cox, Esq., of Gorgie."

This concluded the business before the Meeting.

The Anniversary Meeting of the Society was held in the United Presbyterian Synod Hall, Edinburgh, on the evening of the 6th November, the Right Honourable the Earl of Rosebery, President of the Society, in the Chair. A large number of members and guests were present. The Anniversary Address, which forms our leading article this month, was delivered by Sir William Wilson Hunter, K.C.S.I., C.I.E., etc. A Report of the speeches made on this occasion has been appended to Sir W. W. Hunter's Address.

Mr. Cope Whitehouse opened the Session of the Glasgow Branch of the Society with a Paper on *The Lost Lake Mœris: Egypt and its Engineers.* The

meeting was held in the St. Andrew's Hall, Glasgow, on Tuesday, 13th November —Mr. Renny Watson, Convener of the Branch, in the Chair. After the Address, which was illustrated by lime-light views, a vote of thanks was awarded to Mr. Cope Whitehouse, on the motion of Dr. Muir, seconded by Mr. David Guthrie. Dr. J. B. Russell proposed the vote of thanks to the Chairman.

Mr. Cope Whitehouse repeated his Address at the Opening Meeting of the Aberdeen Branch of the Society, which was held in the Y. M. C. A. Hall on Friday, 16th November. Lord Provost Henderson presided. Professor Pirie moved the vote of thanks to the lecturer.

GEOGRAPHICAL NOTES.

ASIA.

British Proctectorate in Borneo.—We are able to state that an agreement between her Majesty's Government, the British North Borneo Company, the Rajah of Sarawak, and the Sultan of Brunei, embodying the principle of a British Protectorate for the territories of the three last-named, has now been signed by all three. The signature of the Sultan of Brunei has been added only quite recently, as a result of a mission by Sir Hugh Low to Brunei.—*Times*, 31st October.

The Coldest Place in the World.—The town of Verkhoiansk, in north-east Siberia, lies on a flat terrace beside the river Yana, rather more than 5 furlongs from its bank and 30 feet above its surface. The river valley, about $2\frac{1}{2}$ miles broad, is bounded by mountain chains, which are about equidistant from the town. The altitude of Verkhoiansk, according to the reports of the New Siberian expedition, must be about 350 feet above the level of the sea. The winter temperatures are remarkably constant; the warmest and coldest months of January do not show a variation exceeding 5° C., and in the latest corrected observations this variation has never reached 1° C. during four years. Monthly mean temperatures of −50° C. (−58° F.) frequently occur, and minima of −60° C. (−76° F.) are the rule. The monthly mean for January 1887 was −52°·7 C. (−62·9° F.), and the mean for this month during the years 1884-87 was −53·1° C. (−63·6° F.) —*Meteorologische Zeitschrift*, June 1888.

Commerce between Russia and China.—This year has been an important one in the trade relations of Russia and China. *Globus* (No. 16, 1888) states that Russian ships have for the first time carried Caucasian naphtha to Japan and China, and that it can triumphantly compete in these countries with American petroleum. But this is not all. Since 1862, before which time the importation of tea into Russia from Europe was forbidden, Königsberg has had the pre-eminence in the Russian tea-trade. Now, these vessels which take naphtha to China return laden with tea, which they discharge at Odessa.

The Amûr Country as a Field for Colonists.—Hardy colonists will find in the Amûr country everything they ought to expect—security for their persons and goods, fertile lands, virgin forests, rivers full of fish, and mountains rich in metals, and easy communication by means of the forty steamers which ply on the rivers. The mountains do not exceed 6000 feet in height; many of them are well wooded, being covered with conifers in the north, and in the south with oaks, elms, beeches, and maples. The period during which the rivers can be navigated

varies from 160 to 190 days in the year, depending on the breaking up of the ice and on the floods. Large quantities of land are lying uncultivated, and may be obtained at a small price, often gratis. Household utensils and implements of agriculture may be bought in Vladivostock and other towns, as also linen and other clothes, and furs, which are absolutely necessary in the winter. If the colonist lands at Vladivostock, he must hire a carriage to take him to Lake Khanka, whence he may proceed by boat to Khabarovka or further. The population is very sparse, and consists of Russian Cossacks, Chinese, Coreans, and natives. The great drawback to the country is officialism. The Russian Colonisation Office is a place to be avoided. Russian colonists, who are bound to follow its directions, have frequently failed in consequence.—*Revue de Géographie*, Sept. 1888.

China: South-Western Provinces.—Between the end of October 1885 and the beginning of May 1886, the British Consular Agent, Mr. F. S. A. Bourne, made a journey through Sze-chuen, Yunnan, Quang-si, and Quei-chow. Starting from his post, Chun-king on the Yang-tse-kiang, he reached the town of Yunnan chiefly along Rocher's route, whence he advanced in the footsteps of Colquhoun, to Suma, on the frontier of Siam. Then turning eastwards, he skirted Tonkin, and at Nanningfu, on the Si-kiang, turned homewards, traversing Quang-si and Quei-chow in a northerly direction. Though Mr. Bourne undertook this journey with commercial objects in view, he has also brought back a great amount of fresh information regarding the geography and ethnography of the country, especially about the numerous scattered tribes which are not of Chinese descent. His observations furnish ample material for the completion and improvement of the present maps. Numerous observations of elevations were recorded, which, after correction for the error of instruments, will be reliable. The register of the positions of places astronomically determined was unfortunately lost during a a riot at Chun-king.

A journey also has been made by Herr H. Schroeter, a German merchant, along the Si-kiang or West River. He has brought back many interesting notes on the country and people of districts, many parts of which have never been visited by Europeans– namely, the eastern part of the province of Quang-tung, along the southern tributaries of the Si-kiang, whence the largest supplies of *cassia lignea* are drawn. Schroeter considers that it would have an important influence on the development of Central China, if Oo-chow, on the frontier of Quang-si and Quang-tung, were made a treaty-port.–*Petermann's Mitteilungen*, vol. 34, No. x.

The Middle Kuen-Lun Mountains.—The following account of M. Przhevalski's exploration has been abstracted from his book shortly to be published in Russia. The country explored is that of the central range of Kuen-Lun, which lies between 82° and 94° east longitude. The mountains here form a curve, the extremities of which lie in latitude 36° N., and the centre in latitude 38° N. This arc ends to the east in the Marco Polo chain, where it joins the region previously explored by M. Przhevalski (*vide* p. 43, vol. ii.). The Kuen-Lun range here consists of several snow-covered chains enclosing long narrow valleys, where gold abounds. Gold-diggers are said to come every year from East Turkestan, and slip into the mountains behind the backs of the Chinese officials. One of these valleys M. Przhevalski named the *Valley of the Winds*. On the southern boundary of the mountain region, at an altitude of 3600 m. (11,811 feet), a salt lake was found, which was not frozen over at a temperature of 30° C. below freezing point (– 22° F.); only round the margin was the water covered with a

thin coating of ice. This is the lake Carey visited in 1886, and for which he heard the name Tchong-Kum (Kul). A stretch of flat land, saturated with salt, which lay at the south side, showed that the waters of the lake are retiring. Further to the south a singular landscape of hills presents itself: the summits, 320 to 650 feet high, have assumed the forms of towers, battlements, and bridges, and are pierced by sunken ways and tunnels. Beyond these, again, rises a mighty chain of snowy mountains, which the Council of the Russian Geographical Society has decided to name after Przhevalski. The explorer assigned peculiar importance to the Valley of the Winds. It is 130 miles long, 13 miles broad at the upper or western end, and 26 miles at the eastern. The altitude diminishes from 12,796 feet at the western end to 9514 feet at the eastern end. A stream of constantly flowing water runs through the eastern half into the wide swampy table-land of Saïdam, where also the river Saisan-Saitu flows into the swamp Gaz. The extreme cold of the valley dries up the tributary streams in winter, when west winds, often rising to the strength of storms, blow unceasingly. Here on Twelfth Night 1884 the mercury froze, and on December 27 such an icy west wind roared down the valley, that the Russian general and his companions could hardly breathe, much less advance against it. At the same time clouds of sand and dust, as in all the storms in this country, filled the air, rendering it impossible to see more than 30 to 40 paces in front. The little snow that falls is immediately swept away, or mingles with the dust. The rainfall is slight even in summer, and therefore the fauna and flora of the valley are meagre. The Orongo antelope must be fairly common, for twenty-three specimens were killed. In spite of these unfavourable circumstances, M. Przhevalski considered this to be the best route between Eastern Turkestan and Western China. Both the more northern route, running at a lower elevation past Lob Nor, and the southern and higher route suffer under the disadvantage of scarcity of water, fodder, and fuel. In summer none of the three can be used; the northern, owing to the excessive heat, and scarcity of vegetation; the southern, because of the heavy rains, which swell the streams till they become impassable, and soak the dry dung, the only fuel in the country; the middle route, because the salt swamps of Saïdam are then full of water, and swarm with irritating insects. Indeed summer is, as a rule, considered a bad time for long caravan journeys in Central Asia. The distance through the Valley of the Winds, from the Tchertchene Oasis on the west to the town Donkyr, between Kuku Nor and Si-ning, on the east, is 1056 miles. It may be that the Chinese have not used this route, because in former times the northern route to Lake Lob was not so fearfully desolate as it is now, or the Saïdam marshes less easy to cross, and, perhaps, because the nomad tribes which dwelt there were wilder and more addicted to robbery.—*Globus*, vol. liv., No. 13.

The Sanpo Question solved.—An Indian native surveyor, K. P., set out some years ago with a Chinese lama to investigate the course of the Sanpo. By the treachery of his companion he was sold as a slave, but at last succeeded in escaping, and followed the river down-stream. A map has been drawn by Colonel H. C. B. Tanner from the data given by K. P., and a glance at this shows that the identity of the Sanpo with the Brahmaputra can no longer be doubted. K. P.'s furthest point, the mouth of the Zyul or Yangsong Chu (A. K.'s Nagong Chu), is certainly 43 miles distant from the furthest point yet reached on the Dihong, but the Sanpo here flows in a south-easterly direction towards the Dihong. That it afterwards makes a long circuit to the north-east, sweeps round the sources of the Zyul and Dibong, and pours into the Irrawadi, as

R. Gordon still maintains, is incredible, considering the topography of the country.—*Petermann's Mitteilungen*, vol. 34, Nos. vii. and x.

The New Vegetation of Krakatau.—Dr. Treub, of the Buitenzorg Botanic Garden, visited Krakatau in 1886, three years after the volcanic eruption, which destroyed the vegetation of the island. The cinders and pumice stones were almost entirely covered with fresh-water *Algæ* of six different species. Dr. Treub collected also eleven varieties of ferns and twenty kinds of plants, such as usually take possession of newly-raised coral islands.—*Bulletin of the American Geographical Society*, September 30th, 1888.

AFRICA.

A Century of Exploration in Africa.—In 1788 the African Association was formed for the purpose of encouraging travels and explorations in that continent. At that time Africa, with the exception of the Middle and Lower Nile, Senegambia, and the Cape, was almost all unbroken ground. As it would have been unadvisable to attack it on all sides at once, the Association concentrated its efforts on the regions of the Sahara and Sudan. The rest of the continent, however, was not entirely neglected. At the commencement of the present century, Burckhardt travelled in Upper Nubia, Caillaud in the desert east and west of Egypt, Rüppel in Sennaar and Kordofan, and Somerville, Lichtenstein, Burchell and others traversed the regions of the Orange and Limpopo rivers. At this time the question which attracted most attention was that of the Niger. Did this river pour its waters into the Nile, or stop short in the lagoons of Wangara (now Lake Chad)?—or did it flow into the Congo, or into the Bight of Benin? Hornemann and Mungo Park were the first who tried to solve this question. They were succeeded by Tuckey, who ascended the Congo, and Denham and Clapperton, who made a thorough exploration of Lake Chad, and were informed by the Sultan of Sokoto that the Niger flowed into the Bight of Benin. This assertion was verified by the brothers Lander in 1830. About this date the public at large began to take an interest in geography. A Geographical Society was founded at Paris in 1821, another at Berlin in 1828, and a third at London in 1831. The African Association, having no longer a claim to a separate existence, was absorbed by the Royal Geographical Society. From 1830 to 1850 the progress was slow; little change was made in the map of Africa except in Barbary, where France had gained a foothold, the valley of the Nile, and Southern Africa. The discoveries in 1849 of Kilima-njaro and Kenia by the missionaries Rebmann and Krapf, and of Lake Ngami by Dr. Livingstone, ushered in the period of constant progress which commenced in 1850. This period falls into three divisions, 1850-1862, 1862-1877, and from 1877 up to the present time. During the first of these periods great interest was aroused by the expeditions to discover the sources of the Nile. Arnaud (1840) succeeded in ascending the river as far as Gondokoro; and Tremaux, Hartmann, Baker, and others travelled through the country, their routes forming a network, which continually became closer. Since the discoveries of Krapf and Rebmann, attention had been drawn to the Zanzibar coast. Burton and Speke, starting from thence, reached Lake Tanganyika in 1858, and, four years later, Speke, with another companion, Captain Grant, discovered the Victoria Nyanza and the outlet of the Nile, and Baker completed the work by the discovery of the Albert Lake. Meanwhile, Livingstone had been exploring the Zambesi, and had, on his first expedition (1853 to 1856), crossed the continent from east to west. This period is also remarkable for Barth's expedition to Fezzan, the oasis of Asben,

and Timbuktu. One great river yet remained to be explored—the Congo. Livingstone in his third journey explored its upper course, the Lualaba, and its two great reservoirs, the Lakes Moëro and Bangweolo. But no one had any notion of the magnitude of this river, until Stanley returned from his expedition in search of Livingstone, and caused a great sensation by the revelations he proclaimed. Other expeditions of less fame added to our knowledge of Africa—Rohlfs, Nachtigal, and others in the Sudan; Munziger, Rattray, and the English expedition in Abyssinia; Schweinfurth in the Upper Nile; Mauch, Elton, and others in the south; and Pogge and others in the Congo basin. A great event in this last period was the foundation of the African International Association, which had wider aims than the African Association, for it invited people of all nations to come and take possession of the country.

In conclusion, we are informed what remains to be done. Only Cape Colony, the Transvaal, Algeria, Lower Egypt, and Tunis have been traced out by geometricians; Senegambia, Upper Guinea, the White Nile, Abyssinia, the country of the Hottentots, and the basins of the Shiré and the Rovuma have repeatedly been explored, but are not thoroughly known. Of the rest of the continent, some parts have been crossed many times, so that their orography and hydrography are more or less precisely known. Such is the case with the north and west of the Sahara, the Sudan between the Niger and Lake Chad, parts of the Zambesi, and the upper reaches of the southern tributaries of the Congo. On the other hand the country of the Somali, Wadai, Western Sudan, the central Sahara, and the basin of the Congo have been so little visited, that the routes leave blank spaces on the map, which have been left to future travellers to fill in. Finally, there are some regions still enveloped in mystery; the country of the Mandingos, to the north of Liberia, the Grain Coast, the country to the east of the White Nile, and a great part of the basin of the Congo. But the greatest blank of all in the map of Africa lies to the north of the Congo, one of the most interesting parts of the continent, for here must be the watershed between the four rivers, the Congo, the Nile, the Shari, and the Niger.—*L'Afrique*, Oct. 1888. (From the abstract of Dr. Supan's paper in *Petermann's Mitteilungen, Band* 34, vi.).

AMERICA.

Upper French Guiana.—French Guiana rises like an amphitheatre from the sea to the Tumuc-Humac Mountains. The lower part forms a plateau of an average altitude of 300 to 600 feet. This is Lower Guiana. The second plateau, comprising the basins of the Maroni and Oyapok, and rising to the height of 600 to 1300 feet, is Upper Guiana. Its climate is cooler than that of the coast of Guiana, and hotter than that of the south of France. The mean temperature is about 70° F. The air is fresh and invigorating, the sky is always clear. The country is admirably adapted for agriculture. A thick layer of alluvial soil guarantees exceptional productivity. Coco, sarsaparilla, ipecacuanha, copaiba balsam, and frankincense grow wild in the forests, and maize, rice, cotton, arnotto, tobacco, and coffee yield admirable returns. Twenty tribes of Indians inhabit Upper Guiana, and the number of individuals is probably not less than 20,000. The chief tribes are the Rucuyennes, the Oyampis, and the Émérillons. The Indians lay out a great number of plantations, and are not wandering hunters and fishermen, as some have affirmed. Nor are these plantations held in common, but each man makes one or more for himself, and one for each of his wives, sons, and daughters. The men are industrious, and do not leave all work to the women, but build their own huts, hunt, plant, reap, clear the paths, and

make their own implements, bows and arrows. The women make hammocks, bowstrings, and pottery, assist in planting, carry home the arnotto, yams, and other field produce, spin, cook, and attend to their numerous children. Her hammock, necklaces, and cooking-pans are the woman's own property, and, if she leaves her husband, she takes them with her. The villages are abandoned at the end of ten years at most, on account of the scarcity of wood for fuel, or they are left on account of the scarcity of game and fish, and on the death of a chief. The man who founds a village becomes the tamuchi, or chief, of it, and bequeaths his office to his son. His sons-in-law are his peitos, as are also their children, and are bound to do certain tasks at the tamuchi's bidding. Any peito is at liberty to leave the village and establish another, or settle by himself. Formerly these tribes had a chief, who was head of the tamuchis, but they are becoming disorganised, and even the authority of the tamuchis is declining.

The Maroni is the boundary between French and Dutch Guiana. The upper parts of this river were hardly known ten years ago. But now that the country has been more opened up, and especially since the discovery of gold, a question regarding the boundary has arisen, for it is found that two rivers of nearly equal volume combine to form the Maroni, and each nation claims the triangular territory between these rivers, in which the gold diggings are situated. The population of the Upper Maroni consists of runaway Negroes from Dutch Guiana, the Paramacas, the Yucas, and the Bonis. These, now numbering 1545 souls, have for the last 100 years governed themselves. Their officials are the Great Man, the Great Council, and the Captains. The Great Man rules for life, but his office is not hereditary. At the present time he has only judicial power, and just enough authority to make a man hunt or work for him. The authority of the captains and council has almost vanished, and the people manage, as best they may, without any actual government. Since the discovery of gold, the Negroes have made great profits by the carriage of goods for the diggers, by imposing landing dues, etc. These mines, as was before mentioned, lie between the rivers Aua and Tapanahoni, in the disputed territory, and as neither French nor Dutch can exercise authority there, great lawlessness prevails. The French maintain that the Tapanahoni is the true prolongation of the the Maroni, while the Dutch assert that it is the Aua. The questions to be answered are :—Does the Aua or Tapanahoni pour the larger volume of water into the Maroni? which river is the longer? which carries on more nearly the direction of the Maroni? which has the greater ethnographical importance? In 1861 a commission was appointed, presided over by M. Vidal, a naval lieutenant, which decided the first two questions in favour of the Aua, but their conclusions were too hastily formed. As to the ethnographical question, the Bonis, who occupy both banks of the Aua, are protégés of France, and the Yucas, who dwell on both banks of the Tapanahoni, are protégés of Holland. Lastly, a glance at the map suffices to show that it is the Tapanahoni which continues more nearly the general direction of the Maroni. The question is not yet settled.—*M. H. Coudreau in the Revue de Géographie*, October, 1888.

The Natives of the Xingu.—These Indians have had no communication with white men ; they have no knowledge of metals, and are in all respects in the same condition as the natives found by the first American discoverers. The diversity of their language indicates a variety of ethnological groups, so that it is possible that an examination of these tribes may furnish a clue to the classification of the Brazilian aborigines. Accordingly, Dr. Karl v. d. Steinen, who

explored the Xingu in 1884, has made another expedition to that river for the purpose of studying the natives and their language. He and his party left Cuyaba on July 28th of last year, and, passing the Paranatinga, an affluent of the Tapajos, and the Batovy branch of the Xingu, explored in 1884, reached the Kuliseu, where a camp was made, and a portion of the party left in charge of the animals and baggage, while the rest descended the stream in canoes to its confluence with the Batovy. The first Indians they met were of the Bakairi tribe with whom they spent several weeks : the next, the Nahuqua, who have several villages on the Kulisen and the Kuluene, the main branch of the Xingu. Both these tribes are of the Carib family, which, according to Dr. v. d. Steinen, migrated to the Caribbean Sea from Central Brazil. Other tribes are the Anatihu, Vaura, Kustenau Yaualapiti, Camaiura, and Trumai, of which the latter is strikingly different from the others. The natives are short, but well-formed, have a light-coloured skin and dark hair, sometimes wavy. The women wear it loose on the shoulders, but the men cut theirs short. The only clothing worn is a small triangular *tanga* of palm-leaves, used by the women. Every hair on the face, including the eyebrows, and on the body is pulled out, and the skin is rubbed with charcoal or oil coloured with arnotto. The implements these tribes employ are of stone, animals' teeth, bone, and shells.

The journals, from which these details are drawn, agree that they catch fish, but are at complete variance concerning the chase and agriculture. Probably they hunt, and do not engage in agriculture to any great extent, as is usually the case with primitive tribes. They have no domesticated animals, not even dogs. They do not trade with one another, goods passing from hand to hand only as presents. The villages, containing at most 250 inhabitants, are situated on the rivers, and the houses, airy, and round or elliptical in shape, are built round the feasting-house, where guests are also entertained. The women of certain tribes only, belonging to the Nu-Aruak stock, make pottery. Tattooing is also confined to these tribes. The best specimens of manufacture are the masks used in dancing. The men only take part in these dances. They are held in front of the feast-house, into which no woman dare enter. The men on these occasions wear cloaks of palm-fibre, mark the time by shaking a rattle, and sing an accompaniment. Their only musical instrument is a flute of one or three tubes and of all sizes, some being as high as a man. Though excluded from these festivals, the women do not hold a very inferior position. Marriage is monogamous. When a child is born, the father is put to bed and fed on porridge, owing to a belief that there is an intimate connection between the father and child. Descent, however, is traced through the mother. The dead are buried in front of the feast-house, with the head to the east, and holes are made to admit ants and other insects. The Bakairi have a very interesting mythology compiled from observations of nature, legends of ancestors, and hunting stories. The sun, according to the Indian, is a ball of feathers, as is also the moon. The Milky Way is an overturned tree trunk, and a jaguar, ant-eater, etc. may be seen in the starry heavens. These natives have no idea of a god, but believe in a future existence. When a man sleeps and dreams, his soul leaves his body and wanders about, therefore he should not be awakened too suddenly, that the soul may have time to return. Medicine-men are supposed to cure diseases by blowing on the patient and fumigating him with tobacco smoke. The Xingu have no scarcity of nouns. The Bakairi have over 150 names for animals, and about 100 for parts of the body, and the Bororo have 80 for fish. They are quick in observing, but wanting in the power of abstraction. Thus they have a special word for a leaf which they see fall from the tree, while *water*, *river*, *cloud*, and

rain are all denoted by the same word. They have numerals only for *one* and *two*, and have no notion of numbers beyond three. They are very fond of modelling animals in stone or clay, or drawing them on those materials. They make use of a few symbols, such as a triangle for a woman—a representation of her solitary article of dress—a net for a fish, etc.—*Science*, September 7, 1888 ; *Globus*, vol. liv., No. 14.

The Pilcomayo.—M. Thouar, who has made so many journeys in the Grand Chaco, explored in 1885 and 1886 the river Pilcomayo. Its upper course is rendered unsuitable for navigation by numerous rapids, but its sands are auriferous, and its banks fertile. Lower down its valley is swampy. On his return, M. Thouar was commissioned by the Bolivian Government to head an expedition for the purpose of inquiring into the possibility of making a carriage road from Sucre to Puerto Pacheco, on the river Paraguay. The Bolivians were eager about this route, because the right bank of the Pilcomayo is claimed by the Argentine Republic, and the left by the Republic of Paraguay, as far north as 22° south latitude. Twice M. Thouar failed, owing to the scarcity of water and vegetation, but he made a third attempt to cross the Chaco. Eighteen out of the twenty-one men he took with him had to return, overcome by the hardships they endured, and he himself with the three others were saved from death by Colonel Martinez, who went in search of him. M. Thouar reported that the northern part of the Grand Chaco was an extremely arid zone, and was entirely void of water; that it would be impossible to connect Sucre with Puerto Pacheco by means of a road, and that a railway would not pay the cost of construction. The Pilcomayo might be thrown open to navigation by the formation of certain canals, the expenses of which would be, to a large extent, compensated for by the exploitation of the auriferous sands and fertile banks of the river. As this is the only route by which Bolivia can communicate with the river Paraguay and La Plata, she must agree to a delimitation treaty with the Argentine and Paraguay Republics.—*Revue de Géographie*, October 1888.

Dr. Nansen's Expedition across Greenland.—It affords us great pleasure to chronicle the successful accomplishment of the intrepid feat undertaken by Dr. Nansen and his companions, of crossing the inland ice of Greenland from east to west. Telegrams and letters have been received in Copenhagen announcing the safe arrival of Dr. Nansen, with Lieutenant Sverdrup, on 4th October, at the Danish colony of Godthaab. The four other members of the expedition had, it was stated, been left behind at a neighbouring fjord. The expedition having lost the last ship from Greenland, can, we regret to say, hardly be expected home before next May ; but the Society hopes to hear from Dr. Nansen an early account of his adventurous and important journey.

The expedition left the *Jason*, the steamer which conveyed it to the east coast, on July 17th, off Sermilik Fjord (66° north latitude), and was expected to have effected a landing the following day. In this they were, unhappily, unsuccessful. For twelve days they drifted on the ice, suffering great hardships and danger, and eventually effected a landing near Andretok, north of Cape Farewell. From this point they rowed through a lane of open water northward to Uminik, and commenced to cross the inland ice on 15th August.

Dr. Nansen's intention had been to strike across the ice for Christianshaab, Disco Bay, a distance of 400 miles, which he had hoped to cover in thirty days or six weeks. The delay in landing, and a severe northern snow-storm, induced Dr. Nansen to alter his route to Godthaab, where there was a greater chance of

arriving in time to catch the last steamer for Europe. Only for four days were the party snow-bound. For nearly three weeks they experienced, at an average altitude of nearly 10,000 feet, a temperature of – 40° to – 50° C.; the snow and ice were very heavy, and the weather most trying. Great difficulty was experienced in descending from the inland ice to the West Coast at Amerilik Fjord, where an extemporised boat was launched, in which Dr. Nansen and Lieutenant Sverdrup rowed to Godthaab. Two boats have been sent to the bottom of the fjord to fetch the remainder of the expedition.

AUSTRALASIA, Etc.

German New Guinea.—Heft iii. 1888, of the *Nachrichten über Kaiser Wilhelms-Land und den Bismarck-archipel*, contains further details of the ravages caused on the southern coast of New Britain by the great earthquake wave of the 13th March. All hope had been abandoned of the exploring party, which, it may be remembered, landed on the coast a few days before the event, and who were supposed to have been engulfed or swept away by the wave (see *Scottish Geographical Magazine* for September, p. 494). The search party, however, while erecting a cross to mark the site of the catastrophe, provided for all contingencies by establishing a cache of provisions in the neighbourhood. The wave seems to have reached a height of forty feet, and its force may be measured by the fact that for a considerable distance along the coast a belt of forest, one kilomètre in width, had been swept clean away, the land being heaped in places with great fragments of coral rock and trees, and putrefying fish. The natives attributed the catastrophe to the spirit of the volcano of Akaie, offended by the quarrying of stones for building purposes, but they attacked the incoming waves with showers of stones and clubs.

An expedition to New Ireland, not unattended with fighting and loss of life, had found a considerable amount of good land up to a height of 800 mètres, with, in places, a dense population engaged in agriculture; and the same conditions were found in New Hanover.

Another expedition into the Gazelle peninsula had to fight its way back to the coast for three days, owing its safety chiefly to the fact that the natives would not attack after dark, and also, when heavy rain came on, they ceased fighting, and took to manufacturing umbrellas from leaves. Among their weapons were sticks about one mètre in length, of heavy green wood, sharpened at the ends like a boomerang, which they throw with some effect. Agricultural experiments are continued at the various New Guinea stations. Many European vegetables have succeeded; the produce of seeds brought from Queensland doing much better than that raised from European seed. Two years' observation of rainfall seems to have established the fact that the eastern part of the territory, which lies open to the SE., receives its rainfall between June and September—*i.e.* from the SE. trade wind—whereas the western region, sheltered from the SE. by the mass of the Finisterre mountains, and of the high lands projecting from them eastwards, has its driest season at that time, and gets its rains from the NW. monsoon, between December and April.

From the same authority we learn that the Wesleyan Mission in the Bismarck Archipelago has, under the guidance of three English missionaries, a force of forty native teachers, chiefly Fijians, each with a station of his own, with some six to eight hundred converts, besides 4300 attending their preaching, and 1200 children in their schools. They have considerable influence with the natives, who apply to them to settle many of their quarrels.

The Ruk Islands.—These islands, with their surrounding lagoons and reefs, form the largest group of the Caroline Archipelago. They are of volcanic origin and consist principally of basalt. The height of the individual islands varies from 100 to 1300 feet; the length hardly exceeds 5, and the breadth is 2 to 3 nautical miles. The centre consists of a rocky nucleus, conical or dome-shaped, at the foot of which lies a narrow slope covered with *débris* and heaps of stones. Where the sea has thrown up a sand-bank along the shore, low swampy land has been formed between this and the slope just mentioned, which is begirt with mangroves, and forms good taro fields. Owing to the small size of the islands and the steepness of their sides, the water runs off at once instead of forming streams and springs. Hence, in seasons of drought the vegetation dies down, and many natives perish of starvation. The ground, however, is very fertile, and vegetation recovers wonderfully quickly, if the rainy season be fairly good. Coco-nuts, bread-fruit, the *Pandanus*, two varieties of *Barringtonia*, and two of *Carophyllum*, *Ficus prolixa*, *Thespesia populnea*, etc., grow on these islands. Wherever a patch of soil lies between the rocks the native lays out his plantation and grows turmeric, taro, bananas, sugar, and, of late years, water-melons and gourds. All the lofty islands within the lagoon are surrounded by narrow reefs; fifteen islands are inhabited, and also the small island of Pis on the enclosing reef. The largest of these are named Ton or Faituk Fefan, Uola, Toloas and Udot. The population amounts to 12,000, and is divided into 39 different tribes, and 73 independent States. These islands are therefore the most densely peopled of the Carolines, and as several States live on the same island (18 on Faituk), wars are of frequent occurrence. Among the mammalia are found a *Pteropus Kerandrenii*, an *Emballanura* sp. and a *Mut* sp. and also a dog and a cat. The birds are few. The fish are scarce round the islands, but more numerous near the encircling reef. The polyps on the reefs which fringe the island, and on the higher part of the outer reef, are dead. Coral life seems to be confined to the deeper parts of the latter.—*Mitteil. der Geographischen Gesellschaft in Hamburg*, Heft i. 1887-8.

MISCELLANEOUS.

British sovereignty was, on the 4th September last, proclaimed over the Protected Territory of **New Guinea.**

The Government of the **Congo Independent State** have prohibited, by a special decree, the importation of arms and ammunition into their territories.

Dr. John Murray's paper on the "Height of the Land and the Depth of the Sea," which appeared in the January number of the Society's Magazine, has been translated into Russian.

A **New Weekly Journal**, called *La Géographie* (16 Rue de l'Abbaye, Paris), under the editorship of M. Charles Bayle, has been sent to us for inspection. The object of the journal is to popularise and diffuse geographical knowledge, and the first number seems promising.

The Foreign Population of France, in spite of trade restrictions, has trebled itself within the last thirty-five years, and now numbers over 1,126,500, or 3 per cent. of the entire population. Roughly speaking, two-thirds of these foreign settlers are Belgians and Italians, the other European nations being but sparsely represented.

News comes from **Russia** of an important discovery of minerals. An extensive coal-field has been opened in the southern Crimea, and, in the upper Kuban

basin, on its tributaries Dout and Utchkulan, rich veins of silver and lead have been discovered, situated, moreover, at no great distance from a coal-field.—*Globus*, vol. liv., No. 14.

Mr. Pryer, British Consular Agent, Sandakan, has lately published the usual annual report upon **British North Borneo**, and which contains interesting statistics pointing to the increasing prosperity of the territory. Imports show a large advance on former figures, cloth being valued at 190,452 dollars, against 147,341 dollars in 1886 ; kerosine oil, 16,526 dollars, against 7333 dollars ; iron-ware, 5357 dollars, against 10,093 dollars (a notable decrease) ; earthenware, 13,073 dollars, against 2093 dollars. In 1878 the total imports were valued at only 16,000 dollars, cloth, which amounted to 5000 dollars, included. The figures above quoted show that the natives have begun to appreciate and use the commodities available from more civilised countries. Exports are less favourable, showing but a small increase on those for the previous year ; but it is noted that pepper has been, for the first time, sent out of the country, and a valuable trade in this spice is hoped for. Manufactures and agriculture have not yet made much progress ; but there are encouraging signs for the future, and the large area under timber in the neighbourhood of Sandakan appears to favour the view that the port must soon become the principal source of the wood supply of that part of the world. Machinery for sawing and felling timber has been already brought out by a company, and their operations will be followed with much interest. Tobacco is being cultivated to a considerable extent, the kind known as "wrap" tobacco being most popular ; this variety is extremely thin in the leaf, and, being capable of stretching, makes an excellent outer covering for cigars. The profits arising from its cultivation are, it may be added, much larger than can be made from the cultivation of ordinary varieties. There are now six tobacco estates in the territory, owned and worked principally by Dutchmen. During the year, the Commissioners of Lands received applications for grants of land amounting in all to a total of 278,335 acres, of which 218,000 acres were asked for by the Dutch, and 60,000 by Englishmen. Reports of gold discoveries in the river Segama were the cause of several expeditions, none being remarkably successful ; but it is said that the further up the water-course is followed, the more promising are the indications of gold. The small population does much to retard the progress of the territory, but there is a steady increase in the annual number of persons arriving and settling. There is a strong Chinese mixture in the population. "Head-hunting" is not yet extinct, but there are signs of its waning popularity. Roads are being rapidly extended, and the results of speedy and easy communication throughout the land will do much to abolish the barbarous customs, which still exist. As capital is being rapidly drawn to British North Borneo, a demand for skilled labour is almost certain to follow.

Professor W. H. Flower delivered a lecture on **Pygmy races** on the 13th of April last at the Royal Institution. He defined pygmy races as those in which the average height is below 5 feet. The first race considered was the Andamanese, a people rapidly disappearing owing to the introduction among them of the vices and diseases of civilisation, consequent on the establishment of a convict settlement in Great Andaman. Mr. Man gives the average height of the men as 4 feet $10\frac{3}{4}$ inches, and of the women as 4 feet $7\frac{1}{4}$ inches, and Professor Flower's estimated heights, based on the measurement of bones, are still smaller. They possess the curly, frizzly, hair and other characteristics of the Negro, but they are not quite black, and the projecting jaws, thick lips, and

broad flat nose are softened down very considerably in the Andamanese. Negro affinities are most strongly indicated by the relative proportion of the bones. The skull is of the brachycephalic form. They are quite ignorant of metals and agriculture, and live entirely on fish and wild fruits and vegetable. Before the arrival of the British they led a peaceful and innocent life. Many islands of Oceania are inhabited by Negritic peoples, including a large part of New Guinea, the New Hebrides, Fiji, etc.; but these differ from the Andamanese in their larger stature, long, narrow skulls, and coarser features. When the Spaniards commenced to colonise the Philippines, they found in the interior of Luzon a small people, much resembling the Andamanese, whom they called *Negritos del Monte*. In moral characteristics also they are like the Andaman Islanders. Like them they are faithful to the marriage vow, and have but one wife. This small race seems to have extended from Formosa to the Sunda Isles, and were probably the original inhabitants of this part of the world. Remnants of the race exist also at the foot of the Himalayas. In Africa we find the Bushmen, a tribe called *Akoa* by M. Touchard, on the Gaboon river, and the Mbulus on the coast to the north of this river. These are either extinct, or fast approaching extinction. The Bushmen have the flattest noses of any known race, a vertical forehead, and a moderately dolichocephalic cranium. Their yellow complexion, wide cheek-bones, and the shape of their eyes reminds one of the Mongolian races. They are no doubt the earliest of the existing inhabitants of Africa, though at present they extend no further northwards than Lake Ngami. But the most remarkable of all dwarfs are the Akkas, whose country lies in 3° N. lat. and 25° E. long. Dr. Schweinfurth met with them at the court of Munza, king of the Monbuttu, but the measurements he took were unfortunately burnt. Since then Emin Pasha has seen and described them, and has also sent over skeletons of a man and a woman. That of the woman was sufficiently perfect to allow of articulation, and, allowance being made for missing vertebræ, etc., her height may be estimated at exactly 4 feet, while the femur of the male skeleton would indicate a height of a quarter of an inch less. Emin Pasha measured a man only 3 feet 6 inches high, and a woman 3 feet 10 inches. All the Akkas he saw were covered with thick, stiff hair, almost like felt. This is the smallest race living, and they are of normal formation, not broad and out of proportion like dwarfs of a larger race. The only essential point of difference between them and the Negroes is the shortness and breadth of the skull, which, however, is sub-brachycephalous, and not as round as that of the Andamanese. This is a distinct type of Negro, differing both from the pygmy races of Asia and from the Bushmen. Probably this is the people spoken of by Herodotus as dwelling on a river in Central Africa.

NEW BOOKS.

The Unknown Horn of Africa. By F. L. James, M.A. London: George Philip & Son, 1888. Pp. 344. Map, Illustrations, Appendices, Index. 1 vol. *Prices*, 21*s.* or (with hand-coloured plates) 28*s.*

The journey of Mr. James and his companions into Somali-Land, undertaken four years ago, has not received sufficient recognition in scientific circles; the delay in the publication of the narrative volume has been due to the author's absence on other journeys. It will be none the less welcome, for it possesses in itself attractive qualities which are rarely met with in books of travel. The

expedition was one of scientific importance and of considerable danger; it broke entirely new country which had never previously been explored by Europeans; and, moreover, unlike the experience of the majority of previous travellers in the wild country of the Somals, it was successful. That it was conducted with spirit and discretion, in the face of serious obstacles, the narrative modestly proclaims. Mr. James, in commenting on the frequent disasters that have befallen so many explorers in Somali-Land, expresses but the result of his own experience when he says that, provided a caravan is well organised, and strong enough in numbers and equipment, there should not be that element of danger usually met with in traversing the country if only due precaution against being "rushed" or surprised by doubtful tribes is observed on every occasion. His expedition was a very large one, and no expense was spared either in its equipment, or in manfully paying "tribute;" at the same time, all extortionate demands were promptly and firmly refused. It met with, and successfully overcame, imminent dangers; and was, we are glad to say, conducted in a manner that will not prejudice native ideas against succeeding travellers. Into the grave charges which Mr. James makes against the British authorities at Berbera, and the Home Government, we do not feel qualified to inquire: they imply the adoption of a course of official action which might have led to the massacre of the whole expedition.

Starting from Berbera, Mr. James and his party, after passing the coast mountain range, which has limited the explorations of his predecessors, crossed the Habr Gerhajis, the Haud, and the Ogadayn country, and continued the southerly journey to the Webbe Shebeyli. As regards this remarkable river, he says (p. 162):—"The greatest breadth of the Webbe in this part of the country is nearly sixty yards, and there appeared to be a fair amount of water, though we were informed that only a week before our arrival the bed of the river was almost dry. It is a singular fact that the immense volume of water it contains never reaches the Indian Ocean, but after flowing within half a degree of the Equator, loses itself in a vast swamp a few miles from the coast." The Adone people, who occupy fifty-six villages in this part of the country at first received the expedition well; the sultan, however, tried to secure its co-operation in an attack on a neighbouring chief: hence arose difficulties out of which escape was effected by a masterly retreat. Unfortunately, Mr. James could not induce his caravan to undertake the completion of what would have been a most interesting journey, the continuation south to Madisha (Magadoxo) on the Indian Ocean; he therefore returned north to Berbera by a more westerly route. The narrative is highly interesting, and the appendices and notes give information in regard to the scientific results of the expedition.

Mrs. Hake deserves commendation for her dramatic and artistic illustrations of some of the chief experiences of the journey. These, together with the beautiful hand-painted illustrations of birds, etc., combine to make one of the most attractive books of travel that have been published for some time past.

Die Verkehrswege im Dienste des Welthandels. Von. Dr. Wilhelm Götz. Stuttgart: Verlag von Ferdinand Enke, 1888. Pp. 806; mit fünf Karten in Farbendruck.

This portly volume will recommend itself to the student of history as an invaluable store of knowledge concerning the development of international intercourse. To the geographer it will be found a valuable commentary on the science of distances, and the means by which these have been overcome in past times. The author divides his subject into six periods or phases of evolution.

The first period (3000-850 B.C.) includes the centuries of increasing commercial intercourse between the civilised lands of the earliest times, whence arose, first of all, the widely extended commerce of the Phœnicians. No clear light can be thrown on this period by actual figures relating to commercial affairs. The second period (850-264 B.C.) comprises the centuries in which the Asiatic universal empire arose, and, connecting itself with the dominant civilisation of the Greeks, united together the whole of the East. In the third period (264 B.C.-400 A.D.) Roman civilisation exerted itself to bring about an intimate union of all the countries of the Mediterranean, and aspired with some effect to communicate with more distant centres of production, even as far as China. The Middle Ages, which form the fourth period (400-1493 A.D.), were distinguished principally by the addition of the north and east of our Hemisphere to the commercial area of the civilised world, and the union of several countries in Mohammedanism. The fifth period (1493-1819) was introduced by the revolution due to the discovery of the lands of the Western Hemisphere, a necessary condition of really universal trade. The sixth and last period (from 1819 to the present day) is the era of the steam-engine on land and water, beginning with the permanent employment of a river steamer (in America) for the first time. The book offers a practical and scientific discussion of the subject. As a work of reference it will be found extremely useful. The maps deserve special notice for their original information.

Voyage dans le Sud de la Tunisie. Par VALÉRY MAYET, Membre de la Mission Scientifique d'exploration de la Tunisie, Professeur à l'école Nationale d'Agriculture de Montpellier. 2me édition. Revue and augmentée, avec Carte. Paris : Challamel ainé. Pp. 354.

This little volume contains so much information of interest that one is tempted to regret the frequent and *naif* insistence on the ordinary—but evidently, to the writer, unfamiliar—incidents and *contretemps* of uncivilised travel. Still, if these trifles occupy a little of the space which M. Mayet is so competent to fill with more valuable matter, we must recollect that they here constitute only the seasoning, and not, as in too many books of travel, the staple of the narrative. His route lay, in the first instance, from Sfax, on the coast, through the fertile oasis of Gafsa, the ancient Capsa, to the Chott (or, as we in English must write, Shatt) el Gharsa, the westernmost, within Tunisian territory, of those curious depressions which extend into Algeria. The author, partly from his own observations, partly from those of M. Tissot, describes the character of the Shatts, and discusses the proposal, supported characteristically by M. de Lesseps, but now for very sufficient reasons abandoned, to turn them into an inland sea. He describes the great oases in this district, with their marvellous fertility and wealth of date and other fruit trees, showing how, though their actual positions are subject to alteration by the moving sands, they are maintained, and others artificially created, by the conditions of the water-bearing strata. The supply of water he considers capable of further development by the sinking of deep wells. The remains of great Roman aqueducts, sometimes the sole source of water-supply over great distances, as well as other ruins of the same date, bear witness to former prosperity and civilisation. This, according to the writer, received a fatal blow by the immigration of a pastoral race, and consequent deforesting of the country ; and certainly in Marocco the tree-less condition of great tracts of country is ascribed by history and tradition to the same causes.

A curious feature of the more desert tracts is the height of the sand dunes,

150 ft. and upwards; and the author attributes not merely the dunes, but the sand of which they are composed, exclusively to aërial, and not to water action. The volume contains many other interesting notes on the physical geography of the country, on its resources, its flora and fauna. Politically, he is an ardent supporter of annexation in these parts, and alludes with justifiable pride to what we have heard confirmed from impartial sources—viz., the small cost at which in Tunis great results have been achieved under the protectorate. He does not, indeed, add how much of this is due to the absence of interference, and acquiescence in the situation, by other European Governments. We cannot avoid the speculation, What would have been the result in Egypt had we similarly been allowed, or at once assumed, a freer hand there? The writer openly advocates an extension of the protectorate, or annexation, on the first convenient opportunity, over Tripoli, mainly however, as it seems, from the *point d'honneur*, for he candidly admits that the entire foreign trade of all that littoral is in other hands than French. But the possession of Tripoli, though the country itself seems comparatively worthless, would probably give the control of an extensive trade with the countries to the southward.

Untrodden Paths in Roumania. By Mrs. Walker. London: Chapman and Hall, 1888. Pp. 355. *Price* 10*s.* 6*d.*

Mrs. Walker gives us in this volume a very pleasing and well-written account of her travels in Rumania. Instead of following the beaten track of tourists, she takes us through by-paths into the heart of this romantic and prosperous country; though we may not share her passion for churches and monasteries, we cannot fail to be charmed by her cultured observation of the details that combine in presenting a picture of life in Rumania. In her choice of subjects for description, and in the general arrangement of her book, she is to be congratulated. Her talent as an artist is shown in the numerous excellent line-sketches which are inserted in the text.

Of course, in a book of this sort, we are prepared to find a good deal of scrappy, and for the most part useless, information; but nowhere does she vaunt her wares as being possessed of any original or exceptional value. The book is modestly written, and well produced; as such, it is worth the attention of those who may take a passing interest in the country it describes.

A Trip round the World in 1887-88. By W. S. Caine, M.P. Illustrated. Pp. xxiv and 400. London, etc.: George Routledge and Sons, 1888. *Price* 7*s.* 6*d.*

Diaries of travel are too often spoilt for the reader in search of information, by the constant introduction of personal elements, but such an accusation cannot be brought against Mr. Caine's book. Starting from Liverpool, and crossing the Atlantic, the author gives an excellent description of Canada, and the Canadian Pacific route, as well as sound practical information for the use of emigrants to the ranching districts and British Columbia. The Canadian Pacific Railway system is described as most satisfactory, but the present arrangement, by which an independent line of steamers is chartered to convey passengers across the Pacific from Vancouver to Yokohama, does not appear to be a success. Mr. Caine was much impressed by the marvels of Japan and its people; indeed, Japan in his eyes lacks little, for he writes (p. 170): "The only drawback to

Japan is the absence of children's pocket-handkerchiefs." Hongkong, Singapore, Ceylon, and a few of the leading cities of our Indian Empire were also visited, and of each place the author gives an account which shows that he travelled not merely for pleasure, but with the view of collecting reliable statistical information. The concluding chapter on "Social Problems in India," is an epitome of facts worth the consideration of those who have at heart the interests of this large section of the British Empire. The book is profusely and admirably illustrated.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

SESSION 1887-88.

THE COUNCIL has the honour to submit the following Annual Report :—

The fourth Session of the Society has been characterised by steady progress in all the departments of its work.

In carrying out the suggestion made by Mr. William C. Smith, at the last Annual Business Meeting of the Society, that the Council might take steps to initiate more intimate and thorough discussions of geographical questions than can be obtained at the ordinary meetings of the Society, some members of the Council have founded the Geographical Club, which meets once a month throughout the Lecture Session in the Society's Rooms, and is open to all Members. The Club last Session held several interesting meetings, at which papers were read and discussed ; but the Edinburgh membership as a body has not as yet availed itself of the advantages offered by these discussions.

The Society having adopted the recommendations of the Council in regard to the award of Diplomas of Fellowship on Ordinary Members and others, the following applications have been granted :—

DIPLOMAS OF FELLOWSHIP.

Diplomas of Fellowship have been granted to the following Ordinary Members of the Society :—Robert Anderson, Esq. ; Erskine Beveridge, Esq. ; Francis Black, Esq. ; Commander William Brown ; Lieutenant-Colonel Burnley-Campbell ; Hugh Cameron, Esq. ; John Macnaught Campbell, Esq. ; J. M. Easton, Esq. ; Thomas Gibson, Esq. ; Richard D. Graham, Esq. ; John Gunn, Esq. ; Joseph J. Henderson, Esq. ; Robert Kerr, Esq. ; Alexander Laing, Esq. ; Admiral A. L. Mansell ; Robert Mason, Esq. ; Dr. Hugh Robert Mill ; William Morton, Esq. ; John Maclaren, Esq. ; G. M. M'Lauchlan, Esq. ; J. H. Russell, Esq. ; John Shedden-Dobie, Esq. ; Dr. John Stewart ; Frederick Taysen, Esq. ; Alexander B. Thomson, Esq. ; John Tod, Esq. ; Professor Wallace ; Charles Wilson, Esq. ; C. J. Wilson, Esq.

The Council has awarded the Honorary Diploma of Fellowship to the following gentlemen :—Sir Charles Bernard and Hugh A. Webster, Esq. ; also to the following Honorary Corresponding Members of the Society, on their application : —Charles N. Bell, Esq. ; the Rev. Robert Hamilton, D.D. ; and J. P. Thomson, Esq.

Membership.

The following is a Statement of the Membership of the Society, as on 31st October 1888 :—

District.	Membership.
Edinburgh,	632
Glasgow,	240
Dundee,	89
Aberdeen,	60
England, Ireland, India, British Colonies, and Foreign Countries,	123
	1144

Of the above, 111 *are Life-Members.*

The following shows the increase in the Society's Membership during the Session, and the losses by deaths and resignations :—

Membership on 31st October 1887,		1102
Members elected during Session 1887-88,		129
		1231
Deduct Resignations and deletions,	67	
,, Deaths,	20	
		87
Net Membership, 31st October 1888,		1144

The net increase in the Membership during the Session was therefore 42.

Compared with the results of the previous Session : the net annual increase of Membership was exceeded by 9 ; the Edinburgh Membership was increased by 21, the Aberdeen Membership by 6, and the Foreign Membership by 20 ; but the Glasgow Membership was decreased by 7, and the Dundee Membership by 5. Life-Members were increased by 15.

Baron Adolf Erik Nordenskiold was elected an Honorary Member of the Society.

The Honorary Corresponding Members of the Society now number 50. The following fourteen additional Corresponding Members were elected during the year, in countries which were formerly unrepresented, namely :—Audley Charles Gosling, Esq., H. B. M. Embassy, Madrid ; Sir Charles Bernard, for Burma ; Dr. Georg Schweinfurth, Cairo ; Dr. Wilhelm Junker, Berlin ; Professor Carl Hansen, Copenhagen ; M. J. Lamoureux, Rio de Janeiro ; M. de Margérie, Paris ; Major-General Venukoff, for Russia ; Dr. Robert Bell, Ottawa ; H. Gannet, Esq., Washington ; Professor G. Davidson, San Francisco ; J. D. Allen, Esq., for Madagascar ; Griffith N. Cox, Esq., for Jamaica ; Sir James Hector for New Zealand.

The Council is indebted to the Conveners, Honorary Secretaries and Treasurers, and Members of the Local Committees in Glasgow, Dundee, and Aberdeen for the services they have rendered in promoting the interests of the Society's Branches ; also to Mr. James M. Macandrew, the Honorary Auditor, for his valuable services to the Society. The thanks of the Council are also due to Mr. George A. Craig, Chief Clerk, for his assistance to the Honorary Treasurers.

Finance.

The Council submits the following Financial Statement :—

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

For the Year ending 25th October 1888.

FUNDS AT THE CLOSE OF LAST ACCOUNT—			
£1000 Glasgow and South Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
Balance due by the Bank of Scotland, Edinburgh, £6, 9s 5d, and due by the Bank at Glasgow, £4, 4s,		10 13 5	
		£1113 13 2	
Deduct— Due to the Honorary Treasurer,	£9 14 4		
Less— Due by the Secretary,	6 9 1		
		3 5 3	
		£1110 7 11	
ORDINARY SUBSCRIPTIONS—			
20 Life Members, at £10, 10s,	£210 0 0		
1 Do. £10, 10s, less £1, 1s paid last year,	9 9 0		
3 Annual Subscriptions of £1, 1s, year 1884-85,	3 3 0		
8 Do. do., 1885-86,	8 8 0		
41 Do. do., 1886-87,	43 1 0		
957 Do. do., 1887-88,	1004 17 0		
8 Do. do., 1888-89,	8 8 0		
1 Do. do., 1889-90,	1 1 0		
		1288 7 0	
Fees received for Society's Diplomas,		26 5 0	
SUBSCRIPTIONS towards the Society's Scheme for the encouragement of Geographical Education,		6 6 0	
SPECIAL SUBSCRIPTIONS towards the Rankin Exploration Fund,		21 3 0	
PROCEEDS OF LECTURES in Edinburgh, Dundee, Aberdeen, and Glasgow,		23 1 6	
PROCEEDS OF MAGAZINES sold,		81 9 7	
DIVIDENDS and Bank Interest,		41 17 7	
		£2598 11 1	

MAGAZINES, Printing Paper, Lithographing, etc., and Postage for Numbers 8 to 12 Vol. III., 1 to 7 Vol. IV.,			£670 13 11
Less— Received during the year for Advertising therein,			60 0 0
			£610 13 11
GENERAL PRINTING (including £25, 15s. for List of Members),			61 11 1
BOOKS and other Furnishings for Library,			27 16 4
RENTS OF HALLS, and other expenses for Lectures,			104 15 3½
RENT OF COUNCIL ROOM, Taxes and Gas, Repairs, Insurance, etc.,			52 13 1
SALARIES—			
To *Secretary*, 3 months to 10th January 1888 at £200,	£50 0 0		
„ Do., 9 „ to 10th October „ at £250,	187 10 0		
	£237 10 0		
„ *Clerks*, £75; Commission, J. Walker, £15, 14s.,	90 14 0		
			328 4 0
EXPENSES of Secretary attending British Association Meeting at Bath, £17, and for Conference on East African Affairs in London, £6, 13s 9d.,			23 13 9
MISCELLANEOUS, including Stationery, Wages to Office Porter, Messenger, General Expenses, Advertising, Cleaning, Bank Charges and Postages, Office Furniture,			94 11 10½
EXPENSES connected with the Society's Education Scheme,			6 12 9
PURCHASE OF SCIENTIFIC INSTRUMENTS for Rankin Expedition Fund,			39 0 0
Subscription repaid,			1 1 0
FUNDS AT THE CLOSE OF THIS ACCOUNT—			
£1000 Glasgow and South Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,	£1102 19 9		
Balance due by the Bank of Scotland, Edinburgh,	153 19 6		
	£1256 19 3		
Deduct—			
Due to the Hon. Treasurer, £9 14 4			
Less— Due by the Secretary 5 8 1			
	4 6 3		
			1252 13 0
			£2598 11 1

Edinburgh, 2d November 1888.—I have examined the Accounts of the Royal Scottish Geographical Society for the period from 31st October 1887 to 25th October 1888, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

Per JAS. M. MACANDREW, C.A.,
HUGH BLAIR.

Meetings of the Society.

The Society has held 17 Meetings during the Session—8 in Edinburgh (including two Business Meetings), 4 in Glasgow, 2 in Dundee, and 3 in Aberdeen.

The papers read at these Meetings were contributed by:—Sir Charles Bernard, who delivered the Anniversary Address; General Sir Francis de Winton; Mr. H. M. Soltau; Colonel J. Frederick Maurice, R.A.; Mr. H. O. Forbes, the Society's explorer in New Guinea; Mr. John Galloway; the Right Honourable the Earl of Aberdeen; Professor Ramsay, of Aberdeen; and Mr. A. Silva White (two papers).

The papers read and discussed at the Meetings of the Geographical Club were contributed by:—Mr. Joseph Thomson; Dr. Hugh R. Mill; Mr. H. M. Cadell; Mr. Grant Ogilvie; and Mr. A. Silva White (two papers).

Educational Scheme.

A detailed report of the Education Committee on the Examination held by the Society last session has already been published in the Magazine (vol. iv. page 261, *et seq.*) The Examination was held at six different centres, namely, Edinburgh, Aberdeen, Dundee, Nairn, Addiewell, and Gersa (Caithness); and was limited to section C. of the complete syllabus prepared by the Committee two years ago. The total number of candidates examined was 204, from ten schools. Of these, 39 candidates received first-class certificates, the first eighteen also receiving prizes; and 86 candidates obtained second-class certificates. Thus, 125 candidates received certificates; but 79 of the total number failed to satisfy the examiners. In their Report, the examiners expressed their regret that a larger number of schools were not represented in the examination. For this they assign two causes—the one, that many teachers might not have heard of the scheme in time to prepare for the examinations; the other, that many held back from doubt as to the scope of the examination and the kind of paper likely to be set. They remark that the first trial of a new scheme must always be tentative. The Council agrees with the examiners in the opinion that these causes fully account for the limited number of schools that sent in candidates, and they believe that the experience gained in connection with the first examination, and especially by the publication of the examination paper, will induce a much larger number of schools to prepare for the examination next year. In view of this effect, the Council has resolved that the examination next year shall be on the same syllabus as that of last year, though of course the examination paper will be different. The paper of last year served to indicate very clearly the object aimed at by the Education Committee of the Society. In the words of the examiners, it showed "that what is wanted from candidates is not a mere list of place-names, but real knowledge of the ground-work of scientific geography." Small as was the number of competing schools, the Council is glad to be able to agree with the examiners in the opinion expressed by them, that the appearance made by a large number of the candidates "shows that a thoroughly accurate and scientific basis for geographical study can be laid at school."

The thanks of the Society are specially due to the examiners—Professor James Geikie and Mr. Grant Ogilvie—for the very able and suggestive paper which they drew up, as well as for the trouble they took in examining the

written answers. The Council believes that the publication of that paper is likely to effect an improvement in the teaching of Geography in Scottish schools. The thanks of the Society are also due to the publishing firms that presented the committee with books and atlases which were awarded to the best candidates as prizes, namely, Messrs. T. Nelson and Sons, Messrs. W. and A. K. Johnston, Messrs. A. and C. Black, and Mr. John Bartholomew. Mr. Bartholomew deserves further thanks for supplying the certificate forms which he prepared for the Committee.

The Council further desires to recognise the labours of the Education Committee, and especially of its joint Conveners—Mr. W. Scott Dalgleish and Dr. George Merry of Dundee.

Scottish Geographical Magazine.

Professor James Geikie, Vice-President, has been appointed Honorary Editor in place of Mr. Hugh A. Webster, resigned. Mr. J. T. Bealby, who for a period had contributed the bulk of the *Geographical Notes* to the Society's Magazine, having resigned, his work has been added to the duties of the Acting Editor, Mr. A. Silva White.

The Council, in approving of the manner in which the Magazine has been conducted, desires to express its recognition of the services rendered by those who have contributed original articles, and also of the valuable aid accorded to the Editors by Mr. J. G. Bartholomew, Mr. J. T. Bealby, Mr. George A. Craig, Mr. H. N. Dickson, Dr. Robert W. Felkin, Mr. John Geddie, Mr. John Gunn, Dr. Hugh R. Mill, Mr. J. W. M'Crindle, Mr. David Patrick, Mr. Ralph Richardson, and Mr. Coutts Trotter.

Library and Map Departments.

Mr. John Gunn, of the "Challenger" Expedition Commission, was elected Honorary Librarian in place of Mr. David Petrie, whose decease the Council regrets to record. The total additions to these departments up to the end of September numbered 952 items ; namely, 441 new Books, 111 Periodicals, and 400 Maps, Charts, and Atlases.

Several valuable works were added to the Library by purchase, but by far the greater number by presentation. Among the latter were donations from various Departments of the following Governments :—British Guiana, Canada, Cape of Good Hope, India, Italy, New Zealand, United States, Victoria (Australia). These donations chiefly comprised a continuation of the various Government publications mentioned in last year's Report of Council ; their enumeration, therefore, becomes unnecessary.

Valuable gifts of books were also received from the Lords of the Admiralty, consisting of a complete set of *Sailing Directions* ; from the Government of India ; from the Administrator-General of the Gold Coast, and from the Agents-General of New Zealand, New South Wales, and the Cape of Good Hope.

Among the numerous private donors, the principal gifts in books were made by Mr. J. G. Bartholomew, Mr. C. N. Bell, Mr. W. B. Blaikie, Dr. Robert Brown, Mr. Buchanan, M.P., Mr. J. Cockburn, Mr. A. Constable, Dr. Felkin, Dr. Guppy, R.N., Dr. Junker, Mr. Macphail, Herr Metzger, Mr. William Miller, Baron Nordenskiöld, Mr. Ralph Richardson, Professor Veth, Professor Wallace, and Mr. Silva White.

The Map Room has been enriched by many important additions of atlases,

maps, and charts, the chief being a set of the *Indian Atlas* and statistical maps of India (300 sheets) from the Department of the Indian Survey. The Geological Survey of Canada, the Danish Government, the U. S. Hydrographic Office, and the Swiss Government were among those who also contributed maps and charts; and of private individuals, to whom the Society is indebted for similar gifts, may be mentioned—Professor Dr. Hermann Wagner and Mr. Clement L. Wragge.

Exploration.

Mr. Henry O. Forbes, on his return from New Guinea, submitted a Report on the results attained by him in his various attempts to reach the Mount Owen Stanley Peak, at meetings of the Society in Edinburgh, Glasgow, Dundee, and Aberdeen. Mr. Henry O. Forbes's Report, and his original map, were published in the Society's Magazine for August 1888.

The Council, by subscription among its members, also made a small grant of money to Mr. Daniel J. Rankin, in aid of his forthcoming explorations in the Loango-Zambesi basin: the results of Mr. Rankin's geographical work to become the property of the Society.

As indirectly bearing on the results attained by British explorers and others in Equatorial Africa, the Council exercised its influence last Session in the interests of the Scottish missions and trading companies in the Lakes Region who, following in the footsteps of Livingstone and other British explorers, found their existence as independent agencies seriously imperilled by Arab invasion and the political action of Portugal. The geographical aspects of this question were discussed by the Society at several public meetings, and Her Majesty's Government was memorialised by the Council, who sent special delegates on a deputation to Lord Salisbury. The Society's action in this matter was directed to secure, as far as can be secured at the present time, the consolidation of the exploratory and missionary work of Dr. Livingstone and his successors in Eastern Equatorial Africa.

The Council regrets to state that the efforts made in this country, in conjunction with those in our Australian colonies, for the promotion of a Government expedition to the Antarctic Regions, have been provisionally abandoned.

For the Council,

ARTHUR SILVA WHITE,
Secretary.

Edinburgh, 1*st November* 1888.

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